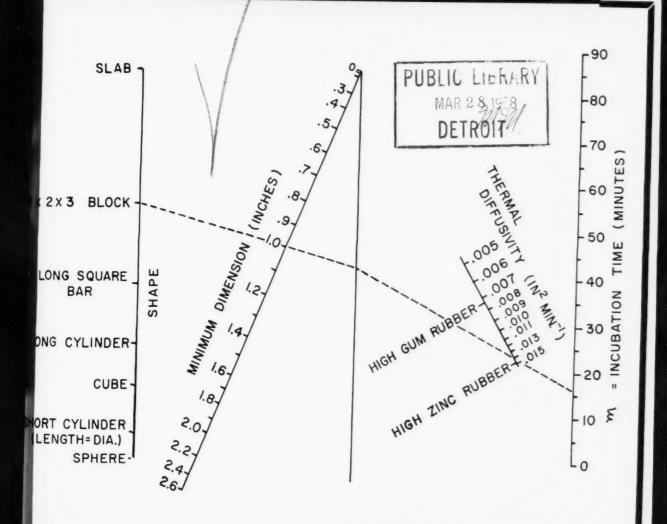
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RUBBER WORLD

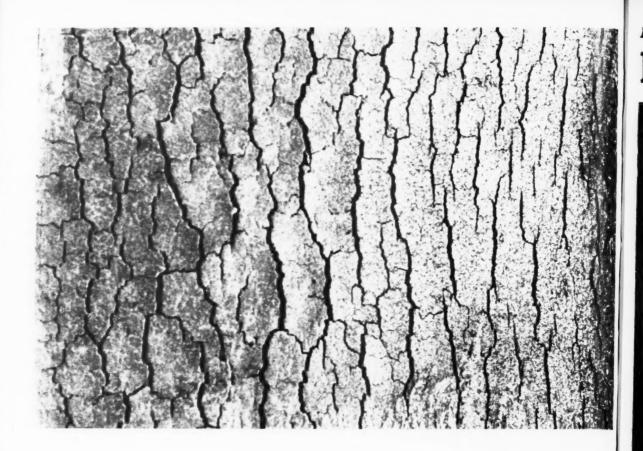
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SERVING THE RUBBER INDUSTRY SINCE 1889



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BLICATION



Protect your SBR products from ozone cracking like this...with Du Pont NBC

The magnified cracks you see in the picture above were caused by ozone. Just the small amount normally found in air has robbed this rubber part of many important properties . . . and its appearance.

Where ozone cracking is a problem, you can extend the life and performance of your SBR products with NBC*, the antiozonant developed by Du Pont *specifically* for use in SBR stocks. NBC retards both dynamic and static exposure cracking . . . adds to product life . . . assures better performance.

In neoprene, where ozone cracking is not a problem.

NBC improves the stock's heat resistance. Neoprene compounds containing NBC show exceptional resistance to embrittlement at service temperatures between 250°F, and 300°F. NBC will also retard sunlight discoloration of colored neoprene compounds.

Investigate Du Pont NBC soon. Contact the district office nearest you.

NOTE: NBC is recommended for SBR and neoprene stocks *only*. Its use is not advised in natural rubber, combinations of SBR and natural rubber, or in any stock which will come in contact with either.

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* NBC is Du Pont's designation for its antiozonant nickel dibutyldithiocarbamate. Ask for Report 56-9.

E. I. du Pont de Nemours & Co. (Inc.)

Elastomer Chemicals Department, Wilmington 98, Delaware

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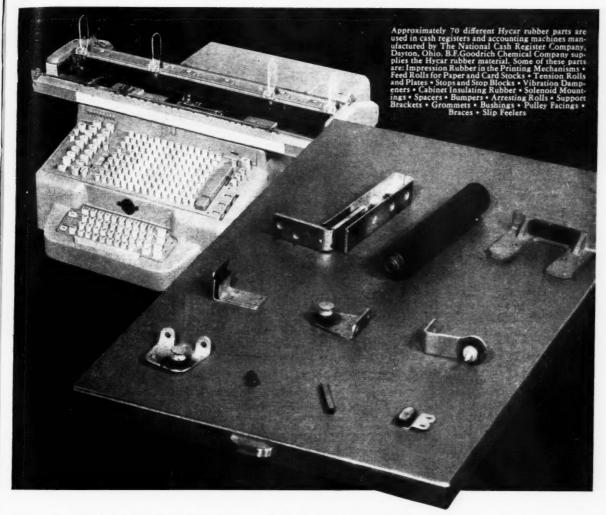


BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Rubber World, March, 1958, Vol. 137, No. 6. Published monthly by Bill Brothers Publishing Corp. Office of Publication, 3rd & Hunting Park Ave., Philadelphia 40, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U. S. A. Entered as Second Class matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879, Subscription United States \$5.00 per year; Canada \$6.00; All other countries \$7.00. Single copies 50c. Address Mail to N. V. Office. Copyright March, 1958, by Bill Brothers Publishing Corp.

News about

B.F.Goodrich Chemical raw materials



OIL RESISTANT HYCAR RUBBER CUTS BUSINESS MACHINE MAINTENANCE

Oabsorb shock, support weight, I deaden sound, supply driving power, dampen vibration . . . these are some of the jobs being done in business machines by parts of Hycar nitrile rubber.

Hycar rubber is ideal for these parts because most of them have to resist oil which destroys ordinary rubbers. Equally important is Hycar's resistance to the attack of solvents and other fluids used for machine cleaning and maintenance.

Versatile Hycar has many other unique properties for applications requiring: flexibility with high strength; superior aging; exceptional resistance to abrasion, oxidation, pressures, gas, temperature extremes and many chemicals.

Hycar nitrile rubber has made possible the development of many new products and the improvement of existing products. For information, write Department KB-3, B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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March, 1958

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RUBBER WORLD

ARTICLE HIGHLIGHTS

CARBON BLACK MOISTURE ADSORPTION IMPORTANT

Moisture adsorption properties of carbon blacks are of practical interest in many rubber and plastics product applications.

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METHOD FOR EQUIVALENT CURES DEVELOPED

A method for providing for the same state of cure in rubber products of various shapes as that found in a standard tensile specimen has been developed.

TOP LIFT COMPOUNDS REQUIRE SPECIAL FEATURES

Compounds to satisfy the unusually severe requirements for present-day ladies' top lifts mean blends of special rubbers and/or fillers.

NEW SCIENTIFIC REVOLUTION MAY BRING CHANGES

The need of even greater attention to fundamental science and of an increased number of scientists and engineers is underscored by the rapid pace of the present revolution in science.

OZONE PROBLEMS; NEW MATERIALS SCIENCE

Latest information on ozone and ozone resistant rubber products, the new science of materials, and ASTM Committee D-11 actions reported from St. Louis.

COMMENTS ON RUBBER INDUSTRY, TIRES, RESEARCH

Contributions of the rubber industry to the nation's strength, latest developments in tires for today's cars, and trends rubber research were explained at the tenth and trends in rubber research were explained at the tenth anniversary Washington Group meeting.



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Cover Photo: Courtesy of The B. F. Goodrich Co.

The opinions expressed by our contributors do not necessarily reflect those of our editors

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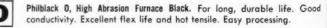
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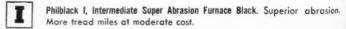
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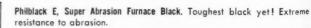
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March, 1958

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ORLD

AGENT 36 SILICONE SQUAD

HOW I GAVE THE NEEDLE TO L.P.*

*LOST PRODUCTION

FROM THE OFFICIAL FILES
OF DOW CORNING

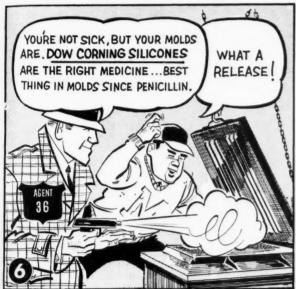


















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ORLD

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Letters to the Editor

Re: Natural Rubber Deficits

DEAR SIR:

I noticed in your October, 1957, editorial a comparison of the deficit between production and consumption of natural rubber during the first half of 1957 with the deficit over the full year 1956.

In view of the seasonal trends, giving a relatively low production during the first half of the year due to wintering, and usually a high consumption. a deficit is quite usual during the first half year, although the full year may ultimately even show a surplus of production over consumption.

Your sentence: "This is the first time in ten years that such a production-consumption unbalance has been recorded" is not correct, as the 80,000-ton deficit you mention, since revised to 85,000, is smaller than the deficit of 110,000 tons recorded for the first six months of 1956.

In your November editorial you again assert that our 1957 data show a greater deficit than comparable data for previous years, although, in fact, the 1956 deficits were larger.

I am calling your attention to this as I always read your very well informed editorials with great interest and sometimes attach a copy to the Digest which I circulate to member Governments of the International Rubber Study Group.

A. G. Pawson Secretary

Secretariat of the International Rubber Study Group, London, England.

We appreciate being informed by Mr. Pawson that the 1957 natural rubber production-consumption deficit was not the first in ten years, but was exceeded in 1956. In our reply we stated that it would have been more correct apparently to refer to both 1956 and 1957 as the first two years in which this production-consumption deficit has appeared. The situation during these two years, we feel, does indicate a trend, however, when examined in comparison with the production-consumption figures for natural rubber during the past ten years.—
EDITOR.

Re: Perforated Pages

DEAR SIR

Perforating the editorial pages of RUBBER WORLD may make it easy for the reader to tear out items of interest to him, but I fear that it will also make it easy to lose pages from bound volumes of the publication. From the librarian's point of view such perforation can be disastrous.

DR. EUNICE C. WALDE

R. T. Vanderbilt Co., East Norwalk, Conn. litor er

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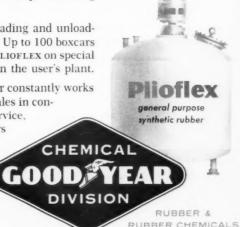
What's in this Seagoing Boxcar for You?

Here's a new way Goodyear can deliver the goods-the better to serve the many users of PLIOFLEX rubber. One of the most unique of all shipping methods-the part-way-by-sea "piggy-backing" of boxcars on a "seatrain vessel" proved a big help to many a Goodyear customer.

Curbing the costly holdups that occur during ordinary ship-loading and unloading, this sea-and-land shipping saves both time and headaches. Up to 100 boxcars travel on one ship. And many of them are factory-loaded with Plioflex on special pallets-opening the door to far-quicker and easier handling in the user's plant.

That's only one example, of course, of the many ways Goodyear constantly works to better service. The pallets are timesavers-carry Plioflex bales in convenient, multiple units. In addition to this new and unique service, strategically located warehouses can fill especially urgent orders -fast. And every customer can obtain all the technical help he needs to get the most out of his PLIOFLEX.

You can be among the many cashing in on this Goodyear brand of service-every time you use Plioflex, the finest of all synthetic rubbers. For its complete story, write Goodyear, Chemical Division, Department O-9418, Akron 16, Ohio. Chemigum, Phofies, Phofite, Phovic-L.M.'s The Goodyear Tire & Rubber Company, Akron. Oni



DEPARTMENT

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

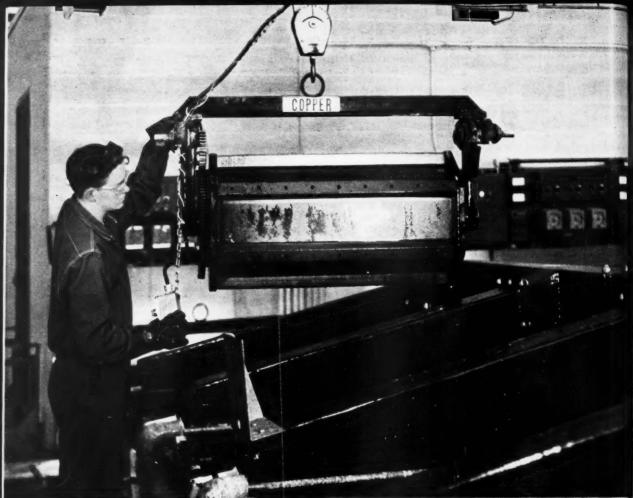


Photo courtesy American Hard Rubber Company, New York, N. Y. and Udylite Corporation, Detroit, Michigan

New Answer to a Barrel of Hot Problems

Hot problem for a leading supplier of electroplating barrels was finding the right material for the cylinders. In the face of repeated exposure to heat, hard wear and corrosive plating solutions, these cylinders had to keep rolling without contaminating the baths. After many tries, they found the answer—a new, clean-running hard rubber with three times longer life.

The major advance of this new material over its predecessors springs from the fact that it's made with Chemigum nitrile rubber. Its manufacturer uses Chemigum for a combination of strength plus resistance to high temperatures, chemicals and solvents never before achieved in hard rubber.

Besides better barrels for plating. Chemigum as hard rubber has wide applications as pipe fittings and other equipment for handling chemicals at high temperatures. In other forms, Chemigum finds use in many other products requiring unusual resistance to oils, solvents and chemicals over a wide range of temperatures.

If you have a need for an unusually versatile oil-resistant rubber of high quality, be sure you have the full story on Chemicum. It's easy to get. Just write to: Goodyear, Chemical Division, Dept. O 9418, Akron 16, Ohio.

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RUBBER &
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oil-resistant

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SUNLIGHT AGING TEST (Styrene rubber)	ANTIOXIDANT "A"	ANTIOXIDANT	WING-STAY T
WINDOW AGING TEST (Styrene rubber) Time to first crack, in weeks	4	6	12
OXYGEN BOMB TEST (Extracted pale crepe gum stock—18 days @ 50° C. and 150 psi) % Tensile retained % Weight increase	0.0 17.55	26.7 1.43	81.4 0.38
CREEP TEST (Styrene rubber gum vul- canizates – open tube @ 110° C.) Hours to 20% creep	10	17	28

A case of more than meets the eye

The samples pictured above tell the more obvious part of the story: There's no beating new Wing-Stay T when it comes to resisting discoloration under sunlight aging.

But there's even bigger news in the data under the samples. They clearly show the superior antioxidant activity—the greater protection for the rubber—offered by Wing-Stay T as compared to other nonstaining antioxidants.

You'll find it worth your while to try Wing-Stay T for

the protection of compounded natural, styrene/butadiene or nitrile rubbers in any of the usual light-colored applications. You'll also find this nonhydrolyzable liquid well suited to the protection of raw polymers.

Full details, including the latest *Tech Book Bulletins*, on Wing-Stay T are yours for the asking. And that's just part of the outstanding service you'll get on this and other products in one of the most complete lines of raw materials for the rubber industry. Just write to: Goodyear, Chemical Div., Dept. 0-9418, Akron 16, Ohio.



GOOD YEAR CHEMICAL DIVISION



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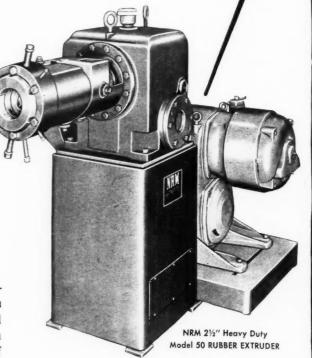
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- EXPERIMENTAL WORK

Size for size, here's the busiest, hardestworking profit maker in rubber extruders you can obtain. Long the tire industry's standard for bead wire insulation, it also "doubles in extrusions" to handle regular production of profiles and pre-mold stock, or to make compound development and pilot operations fast, accurate and economical.

The 2½" Extruder is the quality equal of any large machine in the NRM line, and has many such "big extruder" features as corrosion-resistant Xaloy cylinders for long wear life; under-cut feed boxes for continuous feeding of variously sized stock; and heavy-duty, self-lubricating gear reduction units for durability and long, trouble-free operation.



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March, 1958

LD

Can you improve a GRS compound with one of these resins?

If you are interested in upgrading the properties of GRS compounded stocks, you may find one of these Durez phenolic resins useful.

They serve as effective plasticizers during processing, and also contribute materially to hardness, stiffness or boardiness, and abrasion resistance. These properties are of particular interest for such applications as shoe soles, top lifts, and tire beads.

Generally only 5 to 10 parts of resin per 100 parts of GRS will produce, with normal loading, Shore A hardness of 90 to 100.

Since the resins are thermosetting, the qualities they impart are retained at elevated temperatures. This constitutes a major advantage of phenolic resins over thermoplastic materials sometimes used to increase hardness and stiffness.

Compatibility • Phenolic resins do not have complete compatibility and reactivity with GRS as they do with nitrile-type rubbers. However, you can greatly increase compatibility by using some nitrile rubber in the formulation, serving as a common solvent or flux. This procedure greatly improves over-all physical properties of the vulcanized material.

For use in GRS compounded stocks, we recommend the following resins:



12687 powdered resin • This resin is used only in those instances where ni-

trile rubber is used as the common solvent or flux. It is more compatible with nitrile rubber than are the other resins recommended for use with GRS.



13355 powdered resin • This resin is most generally used with GRS. It is lighter in color than 12687 and more effective, when used without nitrile rubber, in increasing hardness and stiffness. It is suitable for so-called "light oak" shoe soling.



13349 lump resin • This is the base resin used in producing 13355. In this form, it is entirely thermoplastic and is safe for use where high processing temperatures are encountered, as in Banbury mixing. It requires addition of 8% hexamethylenetetramine to make it properly thermosetting and give properties equivalent to 13355. The hexa is added either at the last stage of Banbury or on the warm-up mill.

Where else can Durez resins help you get properties you want?

Nitrile rubber compounds • Completely compatible with nitrile rubbers, Durez resins soften and plasticize the stock, then aid vulcanization with substantial gains in strength, hardness, stiffness, abrasion resistance, heat and chemical resistance of the final cured stock. Compatibility and reactivity increase with increasing nitrile content.

Solvent-type adhesives • You can produce excellent adhesives using Durez resins with nitrile rubber, natural rubber, and Neoprene. Durez resins have been used successfully as an adhesive for bonding uncured and cured nitrile rubber stocks to various metals during molding.

Synthetic rubber latices • A highly effective means of hardening and reinforcing nitrile rubber latices is the use of Durez resin emulsions developed for this purpose. For modifying the properties of latex-treated papers, a water-soluble liquid resin is available. So far, the use of these resins is confined mainly to nitrile rubber latices. However, one Durez resin has produced very satisfactory results with certain high-styrene-butadiene latices.

For a more complete description of the application of Durez resins in compounding, in solvent cements, and in modification of latices, write for the illustrated bulletin, "Durez Resins in the Rubber Industry."



PLASTICS DIVISION

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permanentlyattached couplings mean better service, biggerprofits!

PERMANENTLY-ATTACHED HOSE COUPLINGS COST LESS than re-attachable couplings. Modern hose is of such good quality, lasts so long, by the time hose needs replacing so do re-attachable couplings.

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2 Continuing economy WITH PERMANENTLY-ATTACHED COUPLINGS. You do away with hidden expenses involved in reconditioning re-attachable couplings. No time lost, less paper work, no shipping, etc. 3 machine-attached for 4 leak-proof with PRECISION FITTING AND FULL FLOW. You get a permanently fitted coupling every time . . . there's never a chance of possible costly damage

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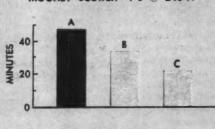
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A. 0.50 DIPAC

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Here is a delayed-action accelerator that is especially suited to modern high temperature processing equipment. DIPAC provides an outstanding combination of long scorch time and good cure time, even in "difficult" compounds such as natural rubber stocks loaded with fast-curing furnace blacks.

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Technical data and performance comparisons on DIPAC are given in our Bulletin S-121B . . . including studies on GR-S 1500 with HAF Black and GR-S 1712 with ISAF Black, as well as on smoked sheet rubber with ISAF Black. To get your copy . . . and a sample of DIPAC for your evaluation . . . just write or call Pennsalt.

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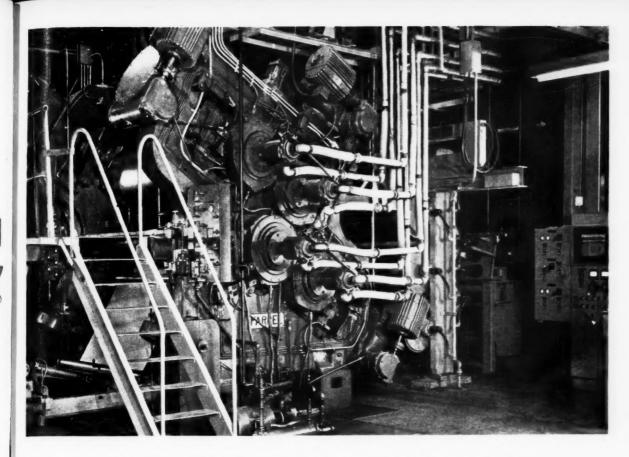
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CROSSED-AXES ACCURACY!

How it helps to improve the quality of Cooper tires

Key unit in a new tire-cord train, installed by Cooper Tire & Rubber Co., is the Farrel-Birmingham* four-roll, inclined "Z" calender pictured here. This machine, says William P. Zimmerman, project engineer, "by controlling uniform thickness and gauge of the tire cord, greatly improves the quality of our product."

Used to double-coat nylon cord with rubber within close tolerances, the calender features two motor-operated crossed-axes devices — one for each bank pass. Push-button adjustments can be quickly made to compensate for variations in stock composition, gauge and speed.

The 24" x 68" calender rolls are inclined at an angle. This arrangement – pioneered by Farrel-Birmingham – has many advantages, including better visibility of bite and greater accessibility to the rolls.

All gears are removed from the rolls and installed in a separate Uni-drive. Power is transmitted smoothly through special universal spindles.

Ask for further information on the inclined "Z" calender.

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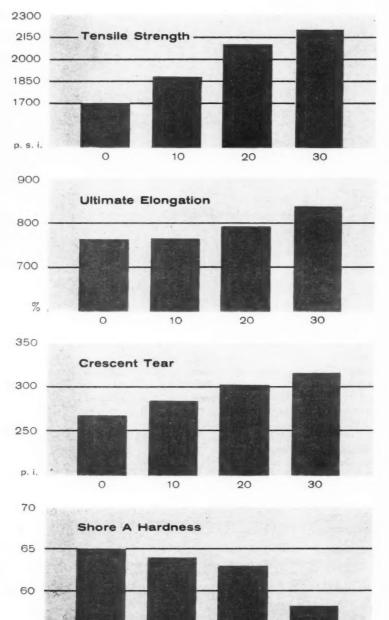
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NEW SIX-ACRE LAB FACILITY WORLD CONSUMPTION - NATURAL AND SYNTHETIC RUBBER PRODUCTION OF NATURAL RUBBER LONG TONS 1000 ADDS TO FIRESTONE SYNTHETIC RUBBER RESEARCH Former giant Government development and test center is now exploring new uses for synthetic rubbers to aid industry in product improvement through use of productspecialized synthetics. Industry predicts that total synthetic rubber production and consumption will double by 1963 to meet the world's total rubber requirements. The recent purchase of the world's largest synthetic rubber laboratory and pilot plant by the Firestone Tire & Rubber Company again emphasizes Firestone's continuing interest in the solution of the problems of the rubber industry. Firestone, world's leading supplier of natural and synthetic rubbers, thus adds to its already vast facilities for polymer research, production and product-application testing. Firestone will use this facility entirely for new polymer research and development, and to supplement its customers' own laboratory. processing and testing work. This expansion makes possible closer coordination of efforts between Firestone and end product manufacturer's personnel and should result in lower product development and improvement costs for industry. Other major advantages of the new facility to manufacturers are Firestone's increased abilities to solve product improvement problems, to assist in planning new products, and to find new ways to

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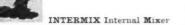
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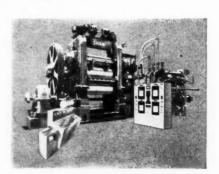


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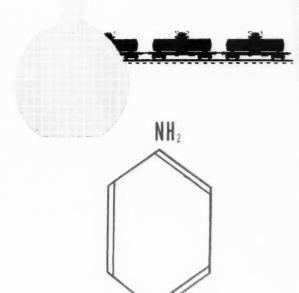
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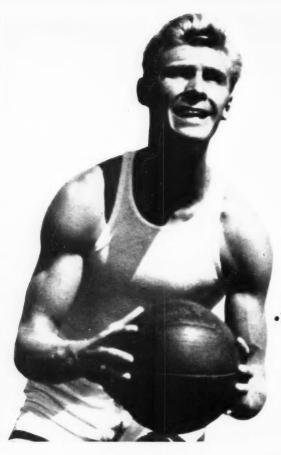
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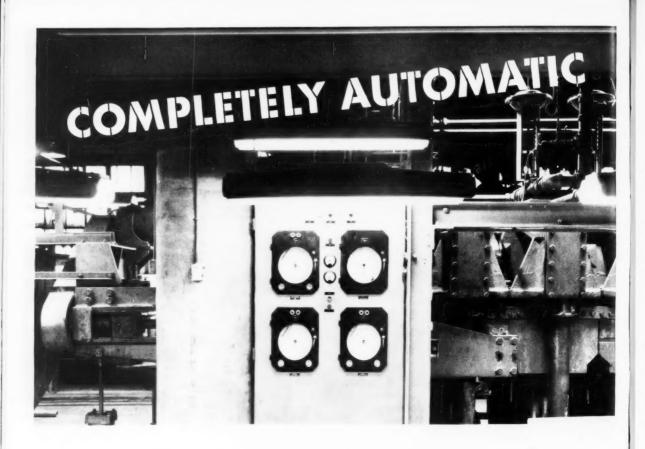
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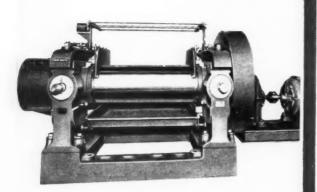
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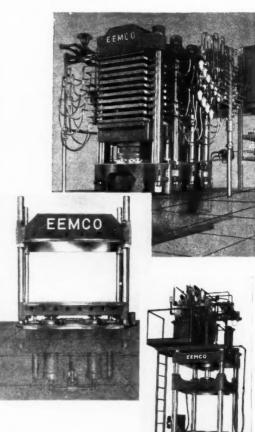
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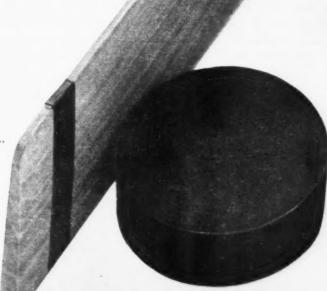
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- 4. Provide permanent elasticity and flexibility.
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- Allow high loadings while maintaining good physical properties and low cost.

More data about INDONEX Plasticizers is available. Inquiries will receive immediate attention.

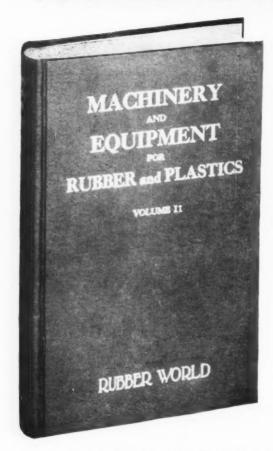


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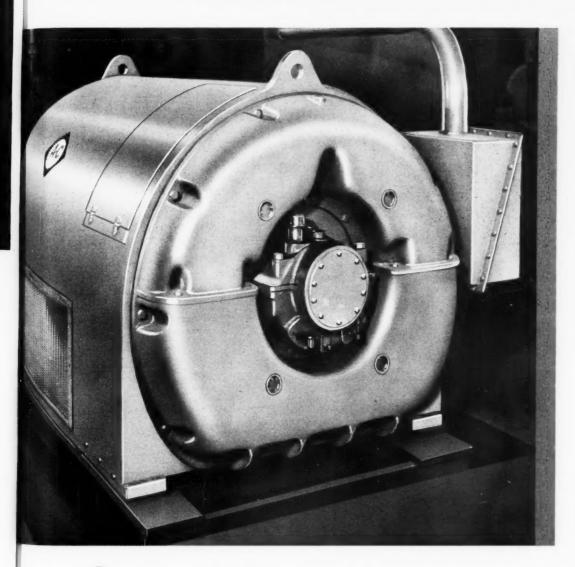
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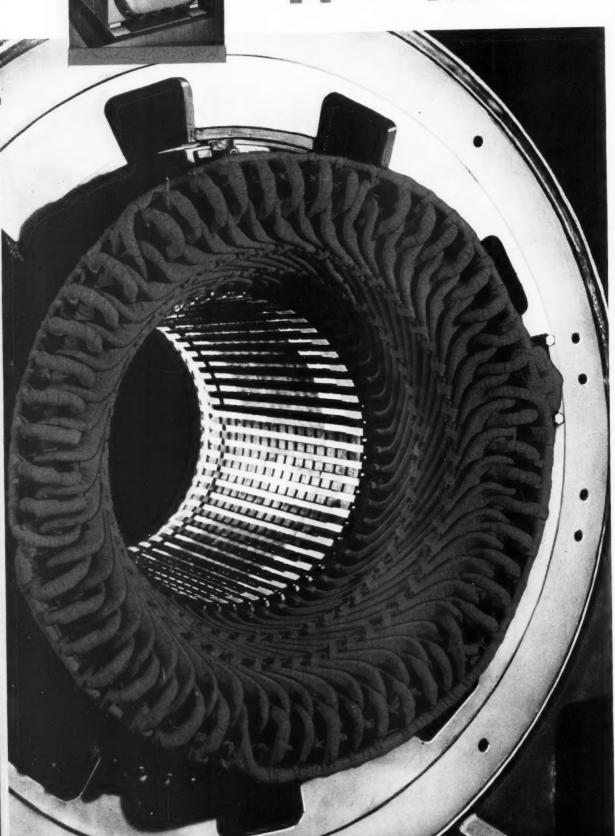


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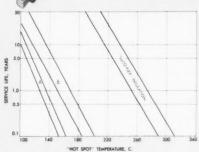
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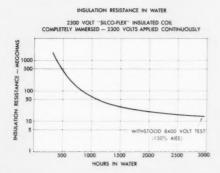


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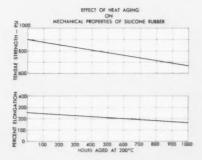


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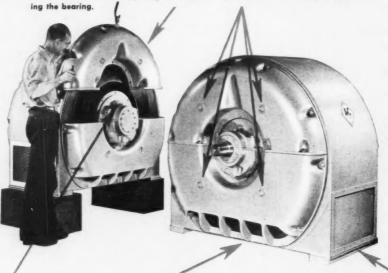
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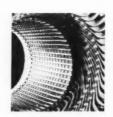


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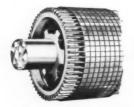
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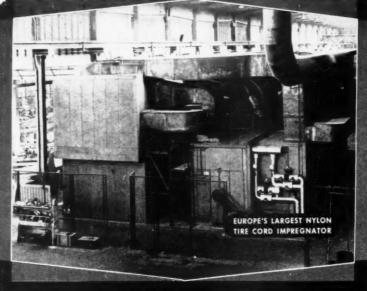
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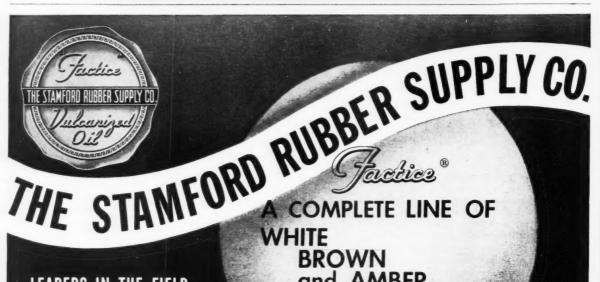


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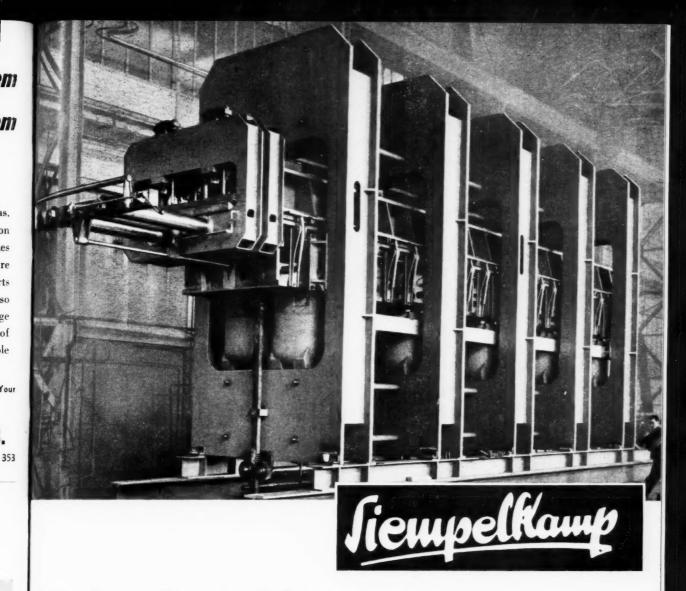
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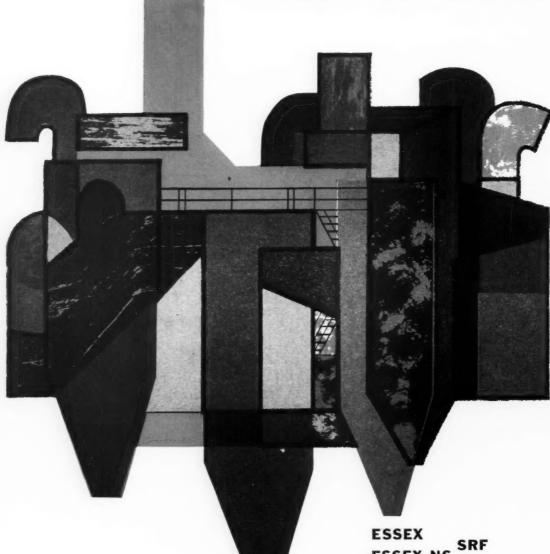
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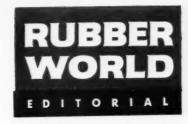
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The New Scientific Revolution And Its Implications

It is probably something more than a coincidence that two leaders in science and technology, one in industry and one in government, in recent talks before rubber and chemical industry people, placed much emphasis on the great changes that are taking place in these fields at the present time. The need of even greater attention to fundamental science and of an increase in this country's supply of scientists and engineers was also stressed.

C. A. Hochwalt, vice president for research, development, and engineering, Monsanto Chemical Co., in a talk at the meeting of the American Society for Testing Materials in St. Louis, Mo., in February, pointed out that we stand on the threshold of a new era in our experience, an era which will bring greater changes than any we have seen before, and which will reshuffle our technologies at a rate of speed which will be terrifying if we are not braced for it. He said this era is being brought into being by what he called the new science of materials.

Allen V. Astin, director of the National Bureau of Standards, in a talk before the tenth anniversary meeting of the Washington Rubber Group in Washington, D. C., in mid-February, explained that the program at the Bureau of Standards on rubber and related organic materials has been gradually shifted over recent years to a more fundamental approach as contrasted with the semi-empirical approach which categorized much of the earlier work. The present objective of the NBS in this field is to provide an explanation of some of the mechanical properties of rubber in terms of molecular structure.

In the new science of materials, Dr. Hochwalt

said, we are dealing in molecular, atomic, and subatomic phenomena, and it is the understanding of these, and their manipulation to meet our new needs, that distinguishes this area as a radical new development in materials technology.

Dr. Astin also touched on Russian activities in science and technology to which we must give utmost consideration if we are to meet the challenge from that quarter. He said that the program for standards and precision measurement is apparently operated from a higher government level than any other industrial activity in the USSR, and that there appears to be a clear tendency to lean heavily on theoretical analysis of technological problems.

These views of Doctors Hochwalt and Astin confirm those of many other individuals and organizations, including those of RUBBER WORLD, which have been expressed in this column during the recent past, that research and development, particularly basic research, need continued encouragement and funds if we are to maintain and improve our relation to the rest of the world.

Technology and technical manpower will continue to increase in importance, and their maximum effective utilization and development are essential to the best interests of management, the scientist and the engineer, and the country as a whole.

P. G. Seaman

EDITOR

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A Study of the Moisture Adsorption Properties of Carbon Blacks—I¹



E. M. Dannenberg



W. H. Opie, Jr.

The Authors

E. M. Dannenberg, director of research, Carbon Black Division, Godfrey L. Cabot, Inc., received his B.S. degree in 1939 and his M.S. in 1940, both from Massachusetts Institute of Technology.

Mr. Dannenberg was a research associate at MIT from 1940 to 1943 and a research chemist for American Cyanamid Co. in 1943 and 1944 and for Sprague Electric Co. in 1944 and 1945. He joined Cabot in 1945.

This author is a member of the American Chemical Society and its Division of Rubber Chemistry, the American Institute of Chemists, and the Institution of the Rubber Industry.

W. H. Opie, Jr., group leader, analytical service department, Godfrey L. Cabot, Inc., attended Lincoln Technical Institute and Northeastern University. He received a B.B.A. degree from the latter institution in 1955 in engineering and management.

Mr. Opie has been with Cabot since 1944 in various capacities and has held his present position since 1956.

By E. M. DANNENBERG and W. H. OPIE, JR.

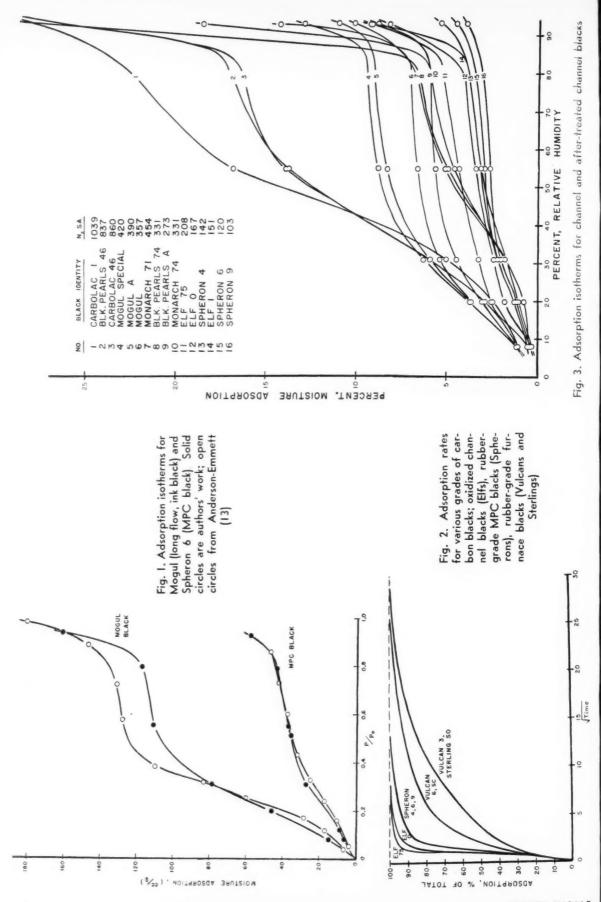
Godfrey L. Cabot, Inc., Boston, Mass.

THE adsorption of water vapor by carbon blacks is of both practical and theoretical interest. Moisture influences the rheological properties of non-aqueous dispersions. For most such systems an optimum amount of moisture seems to be necessary in order to obtain the best dispersion characteristics (1).² In rubber compounds the presence of moisture influences the rate of vulcanization. Excessive moisture can give rise to porosity during the extrusion of both rubber and plastic products. Carbon blacks, as produced, contain very little moisture, but, when exposed to humid atmospheric conditions, they will adsorb increasing amounts at different rates, depending upon the type of black.

The adsorption of polar water molecules on a surface is influenced by many factors including the total surface area, the degree of porosity, size of the pores, and the chemical composition of the surface. The various grades and types of particulate carbon included under the general classification of "carbon blacks" are produced from gaseous and liquid hydrocarbons by a variety of processes. They cover a 50-fold range of particle diameters and a 200-fold range in surface areas. The chemical nature of carbon black surfaces may vary from the one extreme of being essentially "pure" carbon to the other extreme of being almost completely oxidized. In particle porosity they may vary from smooth "billiard ball" particles to highly porous "sponge-like" particles. It is not surprising, therefore, to find that carbon blacks show profound differences in their capacities to adsorb water vapor, and that the shape of the water adsorption isotherm is characteristic for the particular type of carbon black.

Previous work (2-3) has been established that carbon

¹ Presented at the joint meeting of Divisions of Rubber Chemistry, ACS and CIC, Montreal, P.Q., Canada, May 16, 1957.
² Numbers in parentheses refer to Bibliography items at end of this article.



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Moisture Adsorption Properties of Carbon Blacks

The moisture adsorption properties of commercial carbon blacks are of direct practical interest in many product applications. The curing rates of rubber compounds can be either accelerated or reduced by the presence of moisture, depending on the curing systems being used. Excessive moisture in carbon black-loaded polyethylene stocks can give rise to bubbling during extrusion. In ink applications controlled moisture content is beneficial in that it contributes to improved flow characteristics.

A technological investigation of the moisture adsorption properties at various relative humidities of a complete range of commercial rubber and ink grades of carbon blacks and a series of heat-treated MPC blacks was made.

It was found that the rates of moisture adsorption for channel blacks are faster than for furnace blacks. Moisture adsorption in the lower humidity range is dependent more on volatile content of the black than it is on specific surface area. Of special significance is the fact that equilibrium moisture adsorption data at a low and at a high humidity can be used as an approximate method for determining both the volatile content and the surface area of channel-grade carbon blacks.

At humidities greater than 98%, moisture adsorption is sharply affected by bulk density, indicating the occurrence of inter-particle capillary condensation.

The high-temperature treatment of carbon black causes marked changes in moisture adsorption capacity. Heat treatment at lower temperature results in a decrease in moisture adsorption in the lower humidity range without affecting the adsorption in the higher humidity range.

The ash content of furnace-grade carbon blacks is shown to have some influence on moisture adsorption in the high humidity range. At a humidity of 55% where ash content has an insignificant effect, it is possible to show a good correlation between moisture adsorption and surface area for this type of carbon black.

It is shown that a masterbatch of carbon black and rubber will adsorb moisture at a very low rate in quantities related to the particle size and the type of carbon black. The fact that the carbon black surface in rubber is still almost totally active in its ability to adsorb polar molecules has some interesting fundamental implications regarding the nature of the rubber-carbon black interface.

black surfaces are highly heterogenous, being composed of adsorption sites with a wide range of activities. The adsorption of water molecules takes place first on the most active sites at relatively low partial pressures covering only a fraction of the total surface. As the partial pressure is increased, water adsorption occurs on the remaining surface and approaches complete monomolecular coverage. With blacks composed of porous particles, condensation of water in the capillaries probably begins before complete monomolecular coverage is achieved. In these cases it is not possible to estimate accurately the point at which monomolecular coverage is completed. At very high relative pressures condensation also takes place in the interstices between the particles and agglomerates, making it difficult to differentiate between intra-particle and inter-particle capillary condensation.

Prior to World War II, a limited number of practical investigations was made (1, 4) on the carbon blacks commercially available at the time. In 1932, Dewey and Lefforge (5) studied a very complete range of commercially available carbon blacks and concluded that oxidation, as judged from "volatile content," caused a change in adsorptive properties.

World War II stimulated research into the water adsorptive properties of charcoals. A review of this

work has been published by Emmett (6). Although considerable work has been done on charcoals, comparatively little has been reported in recent years on carbon blacks.

Emmett and Anderson (7) studied a group of carbon blacks in their original and "degassed" conditions and showed that the shape of the water adsorption isotherm was markedly altered by degassing at $1000\text{-}1200^\circ$ C. They also estimated that a complete water monolayer for channel black was formed at relative pressures above 0.85, assuming a cross-sectional area for the water molecule of $10.5\,\text{Å}^2$.

Harkins and Jura (8), using a cross-sectional area of 14.8Å² for the water molecule, have estimated the monolayer formation on channel black at a relative pressure of 0.55. Millard *et al.* (9) have estimated monolayer formation on Spheron 6,³ a medium processing channel black (MPC), at a relative pressure of 0.7.

The water adsorption properties of "Graphon," a graphitized MPC channel black, have been of considerable fundamental interest (10, 11) because of its well-defined pure carbon, partially crystallized surface. Compared with the original channel black from which it is produced, Graphon shows profoundly reduced water

³Godfrey L. Cabot, Inc., Boston, Mass.

adsorption properties. Pierce and Smith (12) have estimated that a statistical monolayer of water is formed on Graphon at a partial pressure of 0.99.

These fundamental investigations on the water adsorption behavior of carbon blacks have been almost entirely limited to a few grades of channel black and to Graphon. They have established that extent of carbon black surface, heat treatment, degree of surface oxidation, and porosity influence moisture adsorption.

The purpose of the present investigation was to determine the water adsorption properties for the wide range of presently commercially important channel, furnace, and thermal blacks. The large number of carbon blacks evaluated has helped to assess the relative importance of various carbon black characteristics on moisture adsorption.

Carbon blacks, particularly the furnace and thermal grades, contain small amounts of sulfur, inorganic salts, and soluble hydrocarbon residues, all of which have some effect on moisture adsorption. The bulk density of carbon black, commonly referred to as "free" or "fluffy," and "pelleted" or "densified," has a marked influence on moisture adsorption at high relative humidities. In this study the adsorption properties of a few channel blacks carefully heat treated over a range of temperatures in an inert atmosphere have helped to differentiate effects of surface oxidation or "volatile" content from other changes which occur at high temperature. Data are also presented which show that the capacity of some carbon blacks to adsorb water vapor. although at a much reduced rate, is retained even after the black is incorporated into rubber and the rubberblack system is exposed to a humid atmosphere.

Experimental Procedure

For the purpose of this investigation which surveys the moisture adsorption properties of a large number of carbon black types over the complete humidity range, it was impractical to use an adsorption apparatus which could handle only a single sample. Adsorption equipment which allows the total evacuation of the sample, good temperature control, the introduction of water vapor at an accurate partial pressure, and either the gravimetric or volumetric estimation of adsorption is certainly to be preferred for fundamental work to the technique used here of simply exposing samples in ordinary laboratory desiccators over aqueous solutions having varying water partial pressures.

With the former technique, equilibrium is generally established relatively quickly compared to using humidity chambers, in which equilibrium is established only after exposures of from a few days to months in extreme cases. This is due to the fact that the water molecules in the air humidity chambers have to reach the carbon black surface by diffusion and have to compete for the surface with some physically adsorbed oxygen and nitrogen molecules. Starting with an evacuated system does not entail these difficulties, and equilibrium is rapidly established. On the other hand, carbon blacks in storage pick up moisture in the presence of air, and the air humidity chamber technique gives results which are of greater practical value. The length of time re-

quired to reach equilibrium is not a serious experimental handicap. A slow approach to equilibrium is actually helpful in the appraisal of relative rates of adsorption.

The results reported here are not claimed to be highly accurate in absolute values, but are thought to be good enough to distinguish basic relations among various carbon blacks. The data are reasonably reproducible, having a coefficient of variation of about 2%.

The carbon black samples were placed in weighing bottles and dried for 16 hours at 105° C., prior to exposure to constant relative humidity atmospheres provided by the following reagents in laboratory desiccators.

Relative Humidity	Reagent
8	Aqueous H ₂ SO ₄ (1.615 sp. gr.)
12	LiCl•H2O (sat'd solution)
20	KC ₂ H ₃ O ₂ (sat'd solution)
31	CaCl2•6H2O (sat'd solution)
51	Aqueous H_2SO_4 (1.335 sp. gr.)
5.5	Na ₂ Cr ₂ O ₇ •2H ₂ O (sat'd solution)
79	NH ₄ Cl (sat'd solution)
93	Na ₂ SO ₄ ·10H ₂ O (sat'd solution)

After exposure the sample bottles were closed, removed from the desiccators, and weighed at frequent intervals until equilibrium was established. A correction for the moisture adsorbed on the bottles was made by including an empty bottle with each group. All desiccators were kept in a room in which the temperature was regulated between the limits 22-23° C.

It is of interest to note that the relatively simple technique of using humidity chambers gives adsorption isotherms which satisfactorily confirm similar isotherms reported in the literature obtained by more elegant technique. Figure 1 shows a comparison of isotherms for Mogul⁴ black and Spheron 6 obtained by Emmett and Anderson (13) with our own results. Good agreement was obtained with the MPC blacks, and the difference for the Mogul blacks observed at partial pressures above 0.4 is due to the differences in the surface areas of the samples used.

H₂O Adsorption Rates of Carbon Blacks

There are large differences in the relative rates of approach to equilibrium among blacks. Figure 2 shows the adsorption rates as the percentage approach to equilibrium plotted against the square root of time in hours for a representative group of blacks. The rubbergrade channel blacks (Spherons) and "after-treated" or oxidized channel blacks (Elfs) all attain equilibrium in a period of 2-4 days; whereas the furnace blacks (Vulcans and Sterlings) require about one month. This marked difference in moisture adsorption rates may be associated with the higher chemisorbed oxygen content characteristic of channel blacks. The different adsorption rates shown for the furnace blacks, Vulcan 6 and Vulcan SC, compared with Vulcan 3 and Sterling SO may also be attributed to the higher chemisorbed oxygen content of the former higher surface area, finer particle size blacks.

The fact that different adsorption rates are observed

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¹ Long-flow ink black, Godfrey L. Cabot, Inc.

TABLE 1. PROPERTIES OF VARIOUS CABOT CHANNEL BLACKS

			Electron Microscope Data			Nitrogen	Poro- sity		
Trade Name	Туре	M ajor Use	dn* Å	da* Å	Calc. E.M. Surface Area (m²/Gram)	Adsorption Surface Area (m²/Gram)	Factor N ₂ Area E.M. Area†	Volatile Content (%)	Ratio % Volatile/ N ₂ Area
Carbolac 1	High color	Enamels and lacquers	106	122	264	1040	3.94	18.1	0.0174
46	High color	Enamels and lacquers	141	195	165	860	5.21	16.7	0.0194
Black Pearls 46	High color	Enamels and lacquers	141	195	165	837	5.07	15.0	0.0179
Monarch 71	Medium color	Plastics	176	222	145	454	3.13	4.6	0.0101
74	Medium color	Plastics	164	200	161	331	2.07	4.5	0.0136
Black Pearls 74	Medium color	Plastics	164	200	161	331	2.07	4.3	0.0130
Elf 1	Short flow	News inks	236	298	108	151	1.40	4.6	0.0306
0	Medium flow	News inks	291	343	94	167	1.78	7.5	0.0449
75	Medium flow	News inks	281	345	94	208	2.22	9.0	0.0433
Spheron 4	Rubber (HPC)	Rubber reinforcement	240	307	105	142	1.35	4.5	0.0317
6	Rubber (MPC)	Rubber reinforcement	250	306	106	120	1.13	4.5	0.0375
9	Rubber (EPC)	Rubber reinforcement	298	346	93	103	1.11	4.6	0.0447
Mogul Special	Long flow	Lithographic inks	310	350	92	420	4.57	13.8	0.0329
Mogul	Long flow	Lithographic inks	323	384	84	357	4.25	12.5	0.0350
A	Long flow	Lithographic inks	336	393	82	390	4.76	12.1	0.0310
Black Pearls A	Long flow	Lithographic inks	336	393	82	273	3.33	11.9	0.0437

^{*} d_n, arithmetic mean diameter, $\equiv \frac{2nd}{N}$

for the various blacks indicates different degrees of surface activity for the adsorption of polar molecules. Oxygenated surface sites are known to be strongly attractive to polar molecules and may function as points of entry to the remaining non-oxygenated surface, thus strongly influencing the rates of adsorption even though these oxygenated sites are present in relatively low surface concentrations. This mechanism supports Pierce and Smith (14) who propose in their "cluster theory" that sorption first occurs on the isolated, active, oxygenated sites in the form of clumps of adsorbate which eventually, at higher partial pressures, merge to form a continuous film. It is proposed here that, if the sample is exposed to higher partial pressures, these oxygenated sites will give rise to an increase in the rate of adsorption.

H₂O Adsorption of Channel and "After-Treated" Channel Blacks

Carbon blacks made by the channel process are used in the rubber, ink, paint, enamel, and lacquer industries. The normal types, which are collected directly on the hot-house channels and subsequently pelletized or densified and packaged, are differentiated from the "after-treated" or oxidized types in that the latter have had a secondary treatment at high temperature in an air atmosphere. This treatment increases the amount of chemisorbed oxygen and imparts improved dispersion and flow properties in various fluid systems. The degree of "after-treatment" and the type of raw material used

differ, depending on the specific product application. The increase in "volatile" or chemisorbed oxygen by this process is always accompanied by an increase in surface area and a loss of a fraction of the raw materal by complete combustion.

Table 1 lists the trade names, electron microscope particle size data, nitrogen adsorption surface areas, the ratios of the nitrogen surface areas (total specific surface) to the electron microscope surface areas (external surface) or porosity factors, and "volatile" content for the various channel blacks studied. The "volatile" content, which is measured as a weight loss on heating a one-gram sample in a covered platinum crucible for seven minutes at 955° C., is an indirect measure of the amount of chemisorbed oxygen. Multiplying the "volatile" content by 0.65 gives an estimate of the oxygen content. Table 1 also lists the "volatile" to nitrogen surface area ratios, which are a measure of the degree of specific surface oxidation.

The water adsorption isotherms for this group of blacks are shown in Figure 3 as the percentage weight increase versus relative humidity. The nitrogen surface areas are given for each of the blacks. From an examination of Figure 3 it is apparent that the curves are more or less "S" shaped, with a marked upswing in the region of high humidities. It will be noted that the "after-treated" blacks, which include the Moguls, Black Pearls A, Elf O, and Elf 75, have a less pronounced S-shaped isotherm compared with the normal channel blacks of lower surface areas.

da, mean surface diameter, $=\frac{\Sigma nd^3}{\Sigma nd^2}$

where

n = number of particles of diameter d N = total number of particles counted

[†] E.M. Surface Area (m²/gram) = $\frac{60,000}{1.86d^{\lambda}}$

^{(1.86 =} density of black in grams/cc)

The addition of chemisorhed axygen by "after-treat: ment" causes an enhancement of adsorption in the low humidity region, an effect which has been previously reported (5). It is striking that moisture adsorption in the low humidity region bears no clear relation to surface area: whereas after the curves level out at about 80% relative humidity, moisture adsorption seems to be in the order of the nitrogen surface areas. Since it is already well recognized that chemisorbed oxygen enhances moisture adsorption, it seems from these data that this enhancement is most pronounced at low relative humidities and is not large enough at the higher humidities to mask the surface area effect.

If the assumption is made that the carbon black surface is composed of oxygenated area and non-oxygenated area, each area type having different adsorption activities, the total moisture adsorption can be expressed in terms of these estimated areas as follows:

A_T=total area as measured by nitrogen adsorption.

1) Ao-oxygenated area=k₁V, where V is "volatile" content and k1 is a proportionality constant.

A = non-oxygenated area = A_T - A_o = A_T - k₁V

3) Moisture adsorption $W_M = k_2 (A_0) + k_3 (A_0) = k_2 (k_1 V)$ $\begin{array}{c} +k_{3} \left(A_{7}\!\!-\!\!k_{1}V\right) \\ 4) \ W_{M}\!\!=\!\!k_{4}V\!\!+\!\!k_{3}A_{7}\!\!-\!\!k_{5}k_{1}V \\ 5) \ W_{M}\!\!=\!\!\left(k_{4}\!\!-\!\!k_{3}k_{1}\right)V\!\!+\!\!k_{3}A_{3}\!\!=\!\!k_{5}V\!\!+\!\!k_{3}A_{7} \\ 6) \ \frac{W_{M}}{A_{7}}\!\!=\!\!k_{5}\frac{V}{A_{T}}\!\!+\!k_{3} \end{array}$

From equation 6 a plot of moisture adsorption per unit area versus volatile per unit area should give straight lines whose slope, k5, will be the "volatile"

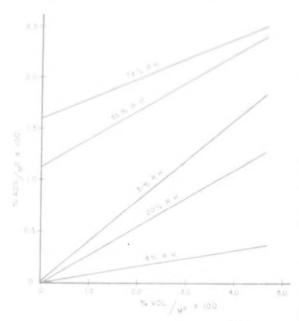


Fig. 4. Moisture adsorption per unit area, volatile content per unit area, - (16 samples including normal and "after-treated" channel blacks)

	TABLE 3	
% Relative Humidity	Total Area Coefficient, k.	"Volatile" Coefficient, k
8	Q	0.8
20	Q	3.0
31	Q	4.0
55	11.2	2.8
79	16.0	2.0

adsorption coefficient, and whose intercept, k3, will be the total surface adsorption coefficient. Figure 4 shows the data plotted in this manner. Table 2 lists k3 and k5, the adsorption coefficients, estimated from the straight lines obtained in Figure 4.

The fact that the area coefficient, k3, is essentially zero up to 31% relative humidity demonstrates that moisture adsorption in this humidity range is not influenced by total surface area, but depends completely on the "volatile" content or the degree of surface oxidation. Above 31% relative humidity k3 increases sharply, and because of the relatively small absolute values of the volatile content, V, compared with the total surface area, A_T, the moisture adsorption rapidly becomes dependent almost completely on total surface area. Thus it appears that the adsorption of water molecules takes place initially on the most active oxygenated sites so that at low partial pressures the adsorption is determined by the total number of sites available. At higher partial pressures, after these more active sites have been saturated, adsorption occurs on the remaining available surface and eventually builds up to a monolayer. At the completion of the monolayer the amount of adsorption is dependent simply on the total surface area.

The water monolayer is completed at a partial pressure of about 0.7-0.85 according to previous workers (7, 9). A plot of moisture adsorption at a partial pressure of 0.79 versus nitrogen surface area gives the expected straight line, as shown in Figure 5. Water adsorption measurements at this partial pressure give an approximate estimate of surface area. Knowing the surface area from moisture adsorption at 79% relative humidity allows one to estimate the volatile content from the moisture adsorption value at 31% relative humidity, using the relation shown in Figure 4 of volatile per unit area versus moisture adsorption per unit area. In this manner the equilibrium moisture adsorption data at two partial pressures can be used to characterize the area and "volatile" content of an unknown sample of carbon black.

In a number of cases where the isotherms for the "fluffy" and pelletized or densified forms of the same grade of black were obtained, it was noted that the pelletized grade adsorbed substantially more water in the region where the isotherm rises sharply close to saturation. At a relative humidity of 93% Carbolac 46 (high-color paint black) adsorbed 32% moisture, in contrast to its pelletized form, Black Pearls 46, which adsorbed 77% moisture. Another example of similar behavior is Monarch 74 (medium-color plastics grade),



Fig. 5. Moisture absorption at 79% relative humidity versus nitrogen surface area

which adsorbed 19% moisture at a relative humidity of 93%; whereas its pelletized form, Black Bearls 74, adsorbed 54% moisture. The influence of bulk density near saturation is most pronounced with the fine particle size, high-color blacks. These blacks, when compacted, possess interaggregate crevices in which additional capillary, condensation seems to occur.

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(To be continued)

NBS and Academy-Research Council Announce New Plan

THE National Bureau of Standards and the National Academy of Sciences-National Research Council have announced an expanded plan for coordination of the NBS technical advisory committee program by the Academy-Research Council in cooperation with a number of the major professional scientific societies of the United States.

The Bureau of Standards, one of the government's major scientific research laboratories, is responsible for maintenance and development of the national standards of measurement and conducts extensive basic research in various fields of science.

The National Academy of Sciences-National Research Council is a non-government organization of the nation's leading research scientists dedicated to the furtherance of science and its use for the common welfare. It is specifically authorized by Act of Congress to advise the Federal Government, upon request, on matters of a scientific or technical nature.

The NBS advisory committee program grew out of the recommendations of a committee appointed in 1953. Since then advisory committees appointed by various professional scientific societies have helped keep the Bureau informed of the needs of the nation's scientific and technological community and have evaluated the work of the Bureau in areas of interest to their professions.

The new plan for coordination of these advisory activities by the NAS-Research Council will strengthen the current program by allowing more complete coverage of the Bureau's diversified research activities, and by providing for the coordination of recommendations from the various professional interests which the Bureau

Under the new arrangement the scientific societies will nominate representatives from among their membership to serve as advisers to the Bureau. From the base provided by these society delegations, the Council will assemble a number of advisory panels, each of which will have responsibility for evaluating a particular segment of the Bureau's work. The panels will report at least once a year on the status of Bureau activities under their cognizance. These reports will form the basis for an integrated annual report by the Council to NBS.

Initial nominations of advisory representatives will be made from the following societies: American Chemical Society, American Institute of Physics, Institute of Radio Engineers, American Ceramic Society, American Institute of Mining, Metallurgical & Petroleum Engineers, American Society of Mechanical Engineers, American Society of Civil Engineers, and American Institute of Electrical Engineers. The Policy Committee for Mathematics will nominate individuals from the various professional mathematics societies.

Equivalent Cures in Specimens Of Various Shapes¹

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A problem which has been of major concern to rubber technologists for many years is that of providing the same state of cure in articles of various shapes and thicknesses.

A report of the work of a task group of subcommittee 10 on physical testing of Committee D-11 on Rubber of the American Society for Testing Materials at its meeting in St. Louis, Mo., February 10-14, seemed to provide an answer to this problem.

THE job of studying the problem of equivalent cures in rubber specimens of various shapes and thicknesses was assigned to a task group of subcommittee 10 of ASTM² Committee D-11 in February, 1957. The assignment was not clear cut, and it was soon apparent that two separate and distinct phases were involved:

(1) How does one adjust the curing times for various shapes and thicknesses to accomplish the same state of cure as in a standard tensile sheet at some specified time and temperature?

(2) How does either the manufacturer or the consumer determine that he has equivalent states of cure when he has a standard tensile sheet cured at a specified time and temperature and a product of different size and shape, but cured at a different time and temperature?

Adjustment of Cure Times

A solution to the first phase of the problem requires a knowledge of the thermal properties of the stock in question, the dimensions of the part to be considered, and the temperature dependence of vulcanization. The latter information is also useful when it is required to transpose cures from one temperature to another.

The problem is confined to determining the added time required to adjust the cure for thicknesses greater than that of a standard tensile sheet. For articles of lesser thickness, no adjustment is required.

Incubation Time

The nomograph shown in Figure 1 permits the calculation of the lag time or incubation time for articles of varying shapes and of varying compositions. The most favorable shape for low lag time is a sphere; while the most unfavorable shape is a thick flat slab of relatively

A nomograph has been constructed which permits the calculation of the lag or incubation time involved in curing articles of varying shapes and compositions. Another nomograph has also been constructed for transposing cure times at one temperature to those at a different temperature.

Suggested test methods are given for determining the state of cure in a product as compared with the state of cure in a tensile sheet when given the "best" or most desirable cure.

large width and length. The second factor is the minimum d'mension. In the case of the sphere this is the diameter, and for a large flat slab it is the thickness. For a block one by two by three inches it would be the one-inch dimension.

The thermal diffusivity is important since this controls the rate of conductance of temperature through the object. The large effect of this factor can be seen at a

It will be seen that the incubation time as scaled from this nomograph is assumed to be independent of the temperature, which is not strictly the case, since if the cure were to be conducted at room temperature, there would be no incubation time. As the impressed temperature increases, the incubation time increases. The nomograph can be assumed to be accurate at 280° F., with approximately a 5% error for temperatures 60° F. higher or lower than 280° F.

Once the incubation time is determined, it is simply added to the cure time of the tensile sheet provided the latter is greater than the former. If the incubation time is longer than the tensile sheet cure, however, a correction needs to be applied which is obtained from the curve in Figure 2. The ratio of the tensile sheet cure, Te, to the incubation time, m, is first calculated. Then from the curve the factor t/m is scaled. This latter factor multiplied by the incubation time gives the cure time.

Thus if the cure time for a tensile sheet is 12 minutes, and the incubation time is 120 minutes, the ratio of te/m=0.10. From the curve, t/m is 0.87, whence t=120x0.87=104 minutes.

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¹Presented before subcommittee 10, ASTM Committee D-11 on Rubber and Rubber-Like Materials, St. Louis, Mo., Feb. 11, 1958.

²American Society for Testing Materials, Philadelphia, Pa.

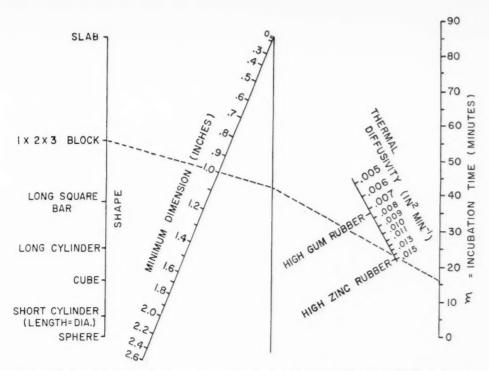


Fig. 1. The size, shape, and compound composition of the article to be cured determine an "incubation" time. This time, denoted by m, may be obtained from the above nomograph. Intermediate shapes may be interpolated on the left-hand scale. The dotted line, for example, shows that a one- by two- by three-inch block of tread stock will have an incubation period of 16 minutes

The construction of both the nomograph and the curve in Figure 2 involves calculations of the curing effect obtained during the heating-up period at temperatures lower than the impressed temperatures. To do this requires an assumption as to the temperature dependence of the cure rate. For this calculation it was assumed that the cure rate is doubled for an 18° F. increase in temperature. There are differences of opinion as to the value of this factor and claims that different curing systems and different polymers respond somewhat differently.

A careful look at published data, however, suggests that most of the work was not too carefully done, and some results are based on sulfur combinations which are not applicable. The value used is an average figure which we believe to be fairly accurate. Actually a large error in this factor makes only a minor difference in the calculations; so this point is relatively unimportant.

Temperature Transposition

Since frequently the establishment of a cure for a product involves not only an estimate of the incubation time, but also a transposition from one curing temperature to another, it should be possible to transpose easily from one temperature to another. In this case the temperature coefficient is more important. Most technical men have one or several charts which have been published or prepared in their own company. These are based on various values for the temperature coefficient,

and most are subject to some question for the reasons given above.

The assumption that a factor such as 2/10° C. will apply over the entire temperature sca'e is subject to an appreciable error for temperatures which are different by a considerable amount. The rate of cure should depend on the absolute temperature, and its logarithm should be inversely proportional to the reciprocal of the absolute temperature. The error is due to the fact that the differences between the reciprocals of curing temperatures which are 10° C. apart are d'fferent at the low end of the range, e.g., 110° C.-120° C. from those at the high end of the range, e.g., 160° C.-170° C.

The nomograph—Figure 3—was constructed on the basis of a reciprocal temperature scale on the right. The latter was constructed on the basis that in the 280° F. range the rate of cure is doubled for an 18° F. increase in temperature.

One additional point should be mentioned. If it is desired to transpose the cure of an article from one temperature to another, and the cure time includes an incubation time, the latter should first be subtracted from the cure time before the temperature transposition is made.

The mistake which would result can be illustrated as follows:

Suppose a product is being cured 60 minutes at 280° F., and the tensile sheet cure is 40 minutes at 280°, and incubation time for the product cure is 20 minutes.

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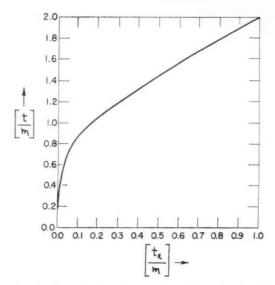


Fig. 2. The relation of the ratios of tensile sheet cure time and incubation time and product cure time and incubation time is used to obtain a correction factor when the product incubation time, as obtained from Figure I, is greater than the tensile sheet cure time

If it is desired to cure this product at 300° F., and the 60-minutes-at-280° cure is transposed by Figure 3 to 300° F., we have 28 minutes at 300° F.

If the incubation time of 20 minutes, however, is first substracted and the transposition made, we find that 40 minutes at 280° F. is equal to 18 minutes at 300° F., and to this is added the 20-minute incubation time, giving a new cure of 38 minutes at a temperature of 300° F.

The reason for this modification of the procedure for equivalent cure determination is the point made earlier that the incubation time is essentially independent of the impressed temperature.

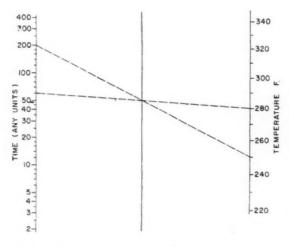


Fig. 3. Nomograph for transposing cure time at one temperature to cure time at a different temperature

Method Check

In the operation of this equivalent cure procedure there are usually two estimates involved which can be in error. In estimating the shape factor the product being considered is usually not a simple geometric shape, and judgment or a guess is involved as to what point to select on the left-hand scale of Figure 1. The second estimate involves the thermal diffusivity of the stock in question, which is not usually known with any certainty. Several values are indicated on the scale as a guide. Also in Table 1 are listed some published data on certain rubbers and compositions.

In practice the usual procedure involves a calculation of the incubation time based on the best estimates of the shape factor and the thermal diffusivity. A trial cure is then run; and based on tests or observations, an adjustment may or may not be required.

TABLE 1. THERMAL DIFFUSIVITIES (IN.3/MIN.) OF RUBBER COMPOUNDS REPORTED IN THE LITERATURE

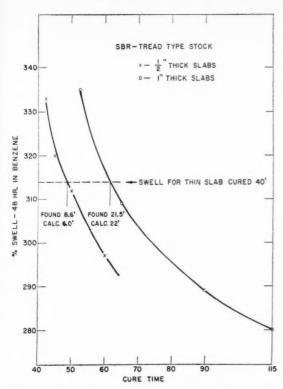
	Hevea	(NR)				
Refer- ence*	Tread	Gum	SBR	NBR	Neoprene (CR)	Butyl (IIR)
(1)	.00613	.0064				
	to .0015					
(2)	.0102		.0115	.0115	.0102	.00836
(3)	.00465					
	to .0093					
(4)	.00743					
	to .0130					
(5)	.00912	.00938				
(6)	.0131		.0152			
(7)	.0094	.0062	.0063	.0080	.0067	.0053

NOTE: Thermal diffusivity values increase with increased pigment loading and decrease with increasing temperature.

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As an illustration of a means by which the lag time or incubation time may be determined as a check against the nomograph of Figure 1, were prepared slabs ½-inch thick and one inch thick and a series of cures run for several of the compositions given in ASTM Method D 15-55T, Method of Sample Preparation for Physical Testing of Rubber Products. Swelling tests were run on specimens cut from tensile sheets cured 40 minutes as well as specimens cut from each of the cures for the thicker slabs. A vertical slice approximately 0.075-inch thick was cut near the middle of each slab, and from these slices specimens were prepared for immersion

Thus each specimen included the more highly cured top and bottom surfaces as well as the less highly cured center section. Swelling tests were run in three labora-



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Fig. 4. Cure times (calculated and found) for 1/2- and one-inch slabs of SBR tread-type stocks

tories. The results obtained were somewhat erratic, particularly with the natural rubber stocks. This factor was investigated further and found to be due to reversion of these stocks with continued cure which gave U-shaped curves of swell versus time of cure, which do not lend themselves well to this technique.

One set of results which came out reasonably well is illustrated in Figure 4. These results were obtained with a SBR tread-type stock, and the data plotted are the averages of the results from the three participating laboratories.

The lag time is scaled off and shown on the curve along with the lag times calculated from Figure 1, using 0.014 as the thermal diffusivity. The agreement is reasonably good.

Product vs. Tensile Sheet Cure

For the second phase of the assignment a procedure is required by means of which the state of cure in a product can be compared with the state of cure in a tensile sheet given the "best" or most desirable cure.

The solution of this problem requires the selection of a property which is sensitive to state of cure. Further, the property should be capable of being accurately measured on specimens of shapes and dimensions different from that of a tensile sheet. Some properties which might be considered are the following:

(1) FREE SULFUR. This determination is applicable only to those materials which are vulcanized with elemental sulfur. It is a good method, when applicable,

and does not depend on the geometry of the specimens.

(2) SOLVENT SWELLING. This test is very sensitive to state of cure. It is applicable to articles or specimens of various shapes provided the material does not contain a high proportion of extractables. If so, specimens of identical size and shape from both the tensile sheet and the product are necessary.

(3) HARDNESS. Hardness tests are fairly sensitive to state of cure, but also dependent on shape and size of specimen.

(4) STRESS-STRAIN, MODULUS AT LOW EXTENSION, ULTIMATE TENSILE AND ELONGATION. Modulus and breaking elongation are very sensitive to state of cure and in some cases tensile strength also. All are influenced, however, by the geometry of the sample, and if buffing is required, both ultimate tensile and elongation are affected. Of these properties, modulus at a low extension is probably the best choice for comparative cure tests.

(5) SET PROPERTIES. Compression set, tension set, creep, and stress-relaxation are all sensitive to state of cure. Compression set may be determined by plying up disks cut from tensile sheets, and if a standard specimen or disks which may be plied up to ½-inch in thickness can be obtained from the article, a good comparison can be obtained. The usefulness of the other tests depends on the possibility of obtaining suitable test specimens.

(6) T-50 Test. This test is sensitive to state of cure for natural rubber products and requires a specimen of specific shape. It is not applicable to other elastomers.

Summary and Conclusions

A procedure has been developed for adjusting the curing times and state of cure of rubber products of various shapes and thicknesses to be equivalent to that obtained with a standard tensile sheet at some specified time and temperature. A nomograph has been constructed which permits the calculation of the lag or incubation time involved in curing articles of varying shapes and compositions. If the incubation time is found to be longer than the tensile sheet cure, a correction is applied. This correction is obtained from a curve relating the ratios of tensile sheet cure time and incubation time to product cure time and incubation time.

Another nomograph was constructed for transposing cure times at one temperature to those at a different temperature. It was constructed on the basis that in the 280° F. range the rate of cure is doubled for an 18° F. increase in temperature.

This procedure for adjusting the curing times of products to be equivalent to that of the standard tensile sheet is demonstrated.

Suggested test methods are given for determining the state of cure in a product as compared with the state of cure in a tensile sheet when given the "best" or most desirable cure. These methods included determination of free sulfur, for materials vulcanized with sulfur; solvent swelling, applicable to articles or specimens which do not contain a high amount of extractables; hardness; modulus at low extension; and set properties.

Super-Quality Top Lift Compounds

By RALPH F. WOLF

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Compounds have been developed to meet the unusually severe requirements for present-day nonmarking ladies' top lifts. One shoe industry firm asked for top lifts with an abrasion index of 150 and a hardness of 52 to 55.

Two types of compounds were found to be satisfactory means of meeting these requirements. In

THE dictate of fashion which has made the heels on ladies' shoes smaller and smaller has at the same time made the life of the sole and heel compounder more and more difficult. This rubber technologist is responsible, among other things, for making satisfactory top lifts for ladies' shoes. As the size of top lifts for these shoes has decreased, the weight per unit area has increased, and the demand for greater hardness and abrasion resistance in top lift compounds has increased proportionately.

Because of their small size present-day top lifts take a severe pounding. They must be hard enough so that they do not spread, resilient enough so that they do not split, and very resistant to abrasion so that they do no wear off at the back edge in relatively short periods of time. Additionally, they must be light-colored or, if black, non-marking.

Specifically, one shoe company recently asked for recommendations for a light-colored compound having a minimum abrasion index of 150 on the National

one case, a carboxylic modified nitrile rubber is used either alone or in combination with other synthetic rubbers and reinforced with a fine particle size hydrated silica and hard clay. In another case, a relatively large amount of phenolic resin is used with nitrile rubber reinforced with the fine particle size hydrated silica.

Bureau of Standards abrader 1 and a Shore D durometer hardness of 52 to 5.

Such requirements automatically limit the choice of reinforcing pigment to fine particle size hydrated silica, Hi-Sil 233.2 Unfortunately even the usual premium soling compounds, all of which are loaded with Hi-Sil 233, do not come up to these levels of hardness and abrasion resistance. Satisfactory super-quality top lift compounds loaded with Hi-Sil 233 have been developed to meet these requirements, however, using two compounding techniques not ordinarily employed in the sole and heel industry. Since spread and nail-holding power are difficult to measure in the laboratory, it will be necessary for interested compounders to examine and judge these characteristics for themselves.

The compounds which were developed may also be of interest to compounders for production of items

TABLE 1. SUGGESTED RECIPES FOR SUPER-QUALITY TOP LIFTS (MIN MUM NBS ABRASION INDEX = 150) OVER A RANGE OF HARDNESSES

Table 4, No. 21	1	Table 4, No. 2	23	Table 5, No. 2	5	Table 3, No.	13	Table 6, No. 3	31
Hycar 1072*	50	Hycar 1072	50	Hv~ar 1072	50	Hycar 1972	100	Hycar 1042	100
1042†	50	1042	50	SBR 1502	50	Hi-Sil 233	60	Durez 12687**	50
Hi-Sil 233	60	Hi-Sil 233	60	Hi-Sil 233	80	Hard clay	60	Hi-Sil 233	60
Zinc oxide	5	Hard clay	40	Zinc oxide	5	Zinc oxide	5	Zinc rxide	5
Santocure İ	1.5	Zinc oxide	5	MBTS#	2	MBTS	1.5	MBTS	1
TMTDS§	0.5	Santocure	1.5	DOTG	0.25	TMTDS	0.25	TMTDS	0.5
Sulfur	2 .	TMTDS	0.5	Sulfur	3	Sulfur	2	Sulfur	2
100° C. m.p.		Sulfur	2	100° C. m.p.		100° C. m.p.		100° C. m.p.	
Coumarone	10	100° C. m.p.		Coumarone	10	Coumerone	10	Coumarone	5
Stearic acid	1	Coumarone	10	Triethanolamine	1	Stearic acid	1	Triethanolamine	4
		Stearic acid	1	Stearic acid	3			Stearic acid	1
Shore D hardness NBS abrasion	47		52		53		61		62
index	419		151		162		171		178

¹ ASTM D394-47, American Society for Testing Materials, Phila delphia, Pa.

Columbia-Southern Chemical Corp., Pittsburgh, Pa.

Medium high nitrile carboxylic rubber, B. F. Goodrich Chemical Co., Cleveland, O.
Medium high nitrile content rubber, B. F. Goodrich Chemical Co., Cleveland, O.
n-cyclohexyl-z-benzothiazole sulfenamide, Monsanto Chemical Co., Rubber Chemicals Department, Akron, O.
Tetramethyl thiuran disulfide.

[#]Benzothiazyl disulfide.

**Phenolic resin, Durez Plastics Division, Hooker Electrochemical Co., North Tonawanda, N. Y.

other than top lifts. Other potential uses include caster wheels, skate wheels, hard rolls, loom parts, football shoe calks, and similar items.

Briefly, these techniques involve use of carboxylic modified nitrile rubber alone or in combination with more common synthetic rubbers or use of high amounts of phenolic resins with nitrile rubber. The compounding work done to develop satisfactory stocks in each of these systems is described in this article. Some recipes which will produce compounds having a minimum NBS abrasion index of 150, at different hardnesses and some difference in cost levels, are suggested in Table 1. Although some of the compounds shown in the other tables have greater abrasion resistance or higher hardness, it was felt that those selected for Table 1 had

the best all-around suitability, considering processability and cost as well as physical properties.

Conventional SBR and NBR Compounds

As a preliminary step, results were obtained on styrene-butadiene rubber (SBR) compounds having higher loadings of Hi-Sil 233 than are normally used in premium soling. These are shown in Table 2. One hundred parts of Hi-Sil 233 in a straight SBR stock produced a 50 abrasion index compound (Compound 1) having a Shore - 'ardness of 38 to 40. Replacement of part of the SBR with high styrene resin had little effect on the abrasion index, but substitution of 20 parts of resin for elastomer (Compound 2) raised the

TABLE 2. SBR AND NBR COMPOUND PROPERTIES Compound SBR 1502 Marben 8000* NBR Hycar 1042 Hi-Sil 233 Zinc oxide 0.5 DOTG 0.5 0.5 MBTS 1.5 1.5 1.5 TMTDS 0.5 0.5 0.5 Sulfur 100° C. m.p. Coumarone 25° C. m.p. Coumarone Circa Oilt Triethanolamine Stearic acid Min. cure @ 320° F. Modulus at 100% Elongation, Psi. 0 0 10 0 Tensile Strength, Psi. 26 0 35€0 Elongation, % 4^0 Shore D Hardness Tear Resistance, Lbs/In. NBS Abrasion Index, % Compared to A TM D 394-47 Control B 49.8 47.6 49.3 57.3 37.9 Unaged 42.8

50 2

61.4

57.9

40.6

51.9

Aged!

r

40.3

^{*} Styrene-butadiene copolymer resin, Marbon Chemical Division, Borg-Warner Corp., Gary, Ind. † Petroleum-base softener, Sun Oil Co., Philadelphia, Pa. ‡ 24 hours at 212° F.

Shore D hardness to 60 and substitution of 40 parts (Compound 3) raised it to 70.

As another preliminary step, similar work was done with a nitrile copolymer (NBR), Hycar 1042, in the expectation that it would give a somewhat higher level of properties than did the SBR, which proved to be the case. A 100-phr. loading of Hi-Sil 233 in a normally accelerated compound vulcanized with normal sulfur (Compound 4) had an abrasion index of about 60 and Shore D hardness of 50. Increasing the sulfur to five phr. and omitting triethanolamine from Compound 4 raised hardness an additional eight points, but sharply reduced abrasion resistance. Substitution of 20 parts of high styrene resin for an equal amount of elastomer in Compound 4 raised hardness 15 points,

but had an even more serious effect on abrasion resistance

Complete physical properties for all of these six compounds are shown in Table 2. Although undoubtedly useful for ordinary top lifts or perhaps for other heel and sole applications, they all fall far short of the requirements specified in this instance.

Carboxylic Rubber Compounds

Since more conventional copolymers gave no promise of providing a solution to the problem by means of ordinary compounding procedures, some tests were made on a carboxylic elastomer, Hycar 1072, known to be useful in producing hard stocks with high abrasion resistance.

	I ABLE 3.	CARBOXYL	IC KUBBE	R (HYCA	R 10/2) C	OMPOUND	PROPER	TES		
Compound	7	8	9	10	11	12	13	14	15	16
Hycar 1072	100	100	100	100	100	100	100	80	80	80
Marbon 8000						-		20	20	20
Hi-Sil 233	100	80	60	60	60	60	60	100	100	80
Hard clay		-	-	40	40	60	60	_		_
Zinc oxide	5	5	5	5	5	5	5	5	5	5
MBTS	1.5	5 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.
TMTDS					0.25		0.25	-		-
Sulfur	2	2	2	2	2	2	2	2	2	2
Triethanolamine			-						4	
100° C. m.p. Coumarone	10	10	10	10	10	10	10	10	10	10
Stearic acid	1	1	1	1	1	1	1	1	1	1
Min. cure @ 320° F.										

Min.	cure	@	320°	F.
		4		

10	0° C. m.p. Coumarone	10	10	10	10	10	10	10	10	10	10
Ste	earic acid	1	1	1	1	1	1	1	1	1	1
M	in. cure @ 320° F.										
				Modulus	at 100% E	Clongation,	Psi.				
8		2160	1770	1210	2470	2700	2850	2960	2790	3500	2320
12		2560	2080	1550	2910	3100	3300	3400	3420	3700	2750
16		2990	2580	1930	3300	3520	3630	3990	3940	3920	3110
20		3350	2780	2150	3610	3670	3860	4210	4200	3860	3510
				Ter	nsile Stren	gth, Psi.					
8		3810	4190	3880	3770	4150	3620	3680	3180	4140	3370
12		4400	4700	4780	4250	4420	4080	4170	3830	4180	3860
16		4560	4940	4790	4310	4520	4250	4500	4330	4340	4020
20		5030	4850	4850	4580	4610	4460	4550	4580	4330	4370
					Elongatio	n, %					
8		360	380	450	350	330	290	240	260	180	360
12		310	360	410	310	320	240	240	190	150	290
16		260	290	350	240	220	210	190	160	140	210
20		200	240	320	250	200	190	140	140	150	190
				S	hore D Ha	rdness					
8		64	52	45	51	55	55	55	69	68	60
12		64	54	48	55	55	59	55	70	70	63
16		66	56	50	58	60	60	61	74	72	66
20		68	58	53	59	62	59	62	73	70	68
				Tear	Resistanc	e, Lbs/In.					
8		820	780	680	600	620	550	530	810	500	900
12		740	880	780	550	490	500	480	750	460	790
16		670	770	650	480	460	500	370	700	430	760
20		470	700	570	480	440	360	350	640	400	680
			NBS, A	Abrasion In	dex, % Co	ompared to	Control I	3			
16	Unaged	372	1172	1267	162	217	123	171	254	130	305
	Aged*	382	1007	1258	228	193	163	174	285	152	359
20	Unaged					249		183			
	Aged*					235		197			
-	24.1										

^{* 24} hours at 212° F.

Hycar 1072 is described³ as "a medium high acrylonitrile-butadiene polymer . . . modified to include carboxylic groups in the polymer chain."

This carboxylic rubber is vulcanized by zinc oxide. Therefore, in working with Hycar 1072, particularly at these nigh loadings it is extremely important to remember that the zinc oxide must be added on the sulfur mill and not before. If it is added with the pigment during the initial mix, scorching is bound to occur. A fast and convenient method of adding the zinc oxide is to use one of the dispersions of zinc oxide in process oil which are now being offered.

The first Hycar 1072 compound mixed contained 100 parts of Hi-Sil 233. As shown in Table 3, this stock (Compound 7) had an abrasion index of 372 and a Shore D hardness of 64; both of these properties are in excess of requirements. The obvious thing to do, of course, was to drop the loading. As expected, hardness at 80 phr. loading was only 54 and at 60 phr. it was 48 (Compounds 8 and 9).

The abrasion index for each of the more lightly loaded stocks is reported in Table 3 exactly as it was measured. The same stocks were retested and were also remixed and tested again. Each time the abrasion results obtained were in the same range. It is more probable than not that these exceptionally high indices are false

	TAI	BLE 4. CARB	OXYLIC NB	R BLEND P	ROPERTIES			
Compound	17	18	19	20	21	22	23	24
Hycar 1072	50	50	50	50	50	50	50	50
1042	50	50	50	50	50	50	50	50
Marbon 8000	-		-	name of the last o	-			20
Hi-Sil 233	80	80	80	60	60	60	60	60
Hard clay				_	_	40	40	
Zinc oxide	5	5	5	5	5	5	5	5
MBTS	1.5	1.5	1.5	1.5	-	1.5	-	1.5
Santocure				-	1.5	-	1.5	_
TMTDS	0.25	0.5	0.25	0.25	0.5	0.25	0.5	0.2
Sulfur	2	2	2	2	2	2	2	2
100° C. m.p. Coumarone	10	10	10	10	10	10	10	10
Triethanolamine	_	-	2		-			_
Stearic acid	1	1	1	1	1	1	1	1
Min. cure @ 320° F.								
		Modulu	s at 100% E	longation, Ps	si.			
8	1380	1560	1490	980	1520	1980	2620	1300
12	1790	1990	1710	1330	1600	2510	2620	1620
16	2030	2060	1730	1540	1640	2570	2800	1870
20	2140	2130	1760	1590	1750	2750	2770	1960
		7	Censile Streng	th, Psi.				
8	2560	3250	3880	2270	4640	2520	3860	2110
12	3190	3730	4100	2880	4730	3060	3820	2420
16	3540	4000	4150	3380	4750	3250	3880	2940
20	3710	3950	3940	3490	4800	3430	3900	3070
			Elongation	, %				
8	290	330	360	330	390	240	270	320
12	290	270	360	340	400	230	210	300
16	270	280	330	350	370	250	230	320
20	260	260	300	330	390	230	260	310
			Shore D Har					
9	51	51	50	44	46	46	52	52
12	51	53	51	47	47	52	52	52
16	53	53	50	46	47	52	52	54
20	54	54	50	48	47	53	53	53
		Te	ar Resistance	, Lbs/In.				
8	550	540	480	500	470	620	460	480
12	560	510	480	450	480	490	440	540
16	510	480	460	440	440	460	390	500
20	500	450	460	440	430	510	380	490
			Index, % Co					
16 Unaged	152	221	179	162	419	68	151	86
Aged*	199	267	234	226	444	84	163	112
20 Unaged	182	218	190		388		143	
Aged*	228	271	236		428		156	

* 24 hours at 212° F.

⁸ B. F. Goodrich Chemical Co., Akron, O. Service Bulletin H-21, June, 1956.

in that the compounds are not 12 times as good as the standard compound, which is ASTM D 394-47 Control B. These stocks do have extremely good abrasion resistance, however, so good that the test samples simply wore out the garnet paper used in the test machine without being noticeably abraded themselves.

Since the compound (9) having 60 phr. of Hi-Sil 233 was obviously still much better than the requirements, the effect of adding hard clay to this stock was investigated. It was thought that addition of the less reinforcing pigment would increase hardness, bring abrasion resistance down to the desired level, and also help cheapen the compound, and this was found to be the case. The c'ay addition also reduced rate of cure, and it was found necessary to add a secondary accelerator, TMTDS. Compounds 10 through 13, Table 3,

TABLE 5. CARBOXY'IC RUPBER AND SBR BLEND PROPERTIES

Compound	25	26	27	28
Hycar 1072	50	50	50	50
SBR 1502	50	50	50	50
Marbon 80 0	parties and the same of the sa	-		20
Hi-Sil 233	80	60	60	60
Hard clay		-	40	discourse
Zinc oxide	5	5	5	5
MBTS	2	2	2	2
DOTG	0.25	0.25	0.25	0.25
Sulfur	3	3	3	3
100° C. m.p. Coumarone	10	10	10	10
Triethanolamine	1	1	1	1
Stearic acid	3	3	3	3

Min. cure @ 320° F.

N	In. cure @ 320°	F.				
	Mode	ulus at 100% 1	Elongatio	n, Psi.		
1	8	2090	1460	2220	1640	
12	2	2300	1640	2390	1770	
16	5	2340	1660	2390	1820	
20)	2410	1700	2500	1880	
		Tensile Stren	gth, Psi.			
8	3	2750	2970	2600	2580	
12	2	2890	2960	2940	2800	
16	5	3020	2940	2940	2840	
20)	3120	3190	2930	2620	
		Elongation	n, %			
8	3	150	300	160	280	
12	}	150	260	190	270	
16		170	240	160	280	
20		170	270	160	230	
		Shore D Ha	rdness			
8		. 52	45	53	53	
12		53	46	54	54	
16		53	47	54	55	
20		54	48	55	55	
	T	ear Resistance	, Lbs/In			
8		350	310	360	370	
12		330	290	410	330	
16		350	280	390	340	
20		330	300	360	330	
	NBS Abrasion	n Index, % Co	mpared	to Contro	l B	
16	Unaged	162	177	76	127	
	Aged*	211	235	81	164	

^{* 24} hours at 212° F.

TABLE 6. NBR AND PHENOLIC RESIN BLEND PROPERTIES

Compound	29	30	31	32
Hycar 1042	100	100	100	100
Durez 12687	50	50	50	50
Hi-Sil 233	80	70	60	50
Zinc oxide	5	5	5	5
MBTS	1	1	1	1
TMTDS	0.5	0.5	0.5	0.5
Sulfur	2	2	2	2
100° C. m.p. Coumarone	5	5	5	5
Triethanolamine	4	4	4	4
Stearic acid	1	1	1	1

Min. cure @ 320° F.

202	im care @ oao				
	Mod	ulus at 100% l	Elongatio	n, Psi.	
12	2	2160	2100	2030	1820
16	3	2240	2170	2170	1940
20		2350	2250	2200	2010
30		2570	2470	2440	2170
		Tensile Stren	gth, Psi.		
12		2900	2810	2810	3140
16		2850	2830	2840	3080
20		2930	2840	2830	3020
30		3000	3050	2910	3220
		Elongation	n, %		
12		210	220	230	310
16		180	210	210	240
2)		180	200	190	250
30		140	170	150	250
		Shore D Ha	rdness		
12		63	63	62	60
16		65	64	62	59
20		63	67	62	61
30		64	67	62	61
	7	Cear Resistance	, Lbs/In		
12		540	540	550	500
16		590	570	560	490
20		520	530	580	480
30		540	520	510	490
	NBS Abrasio	n Index, % Co	mpared	to Contro	l B
16	Unaged	178	1 3	178	159
	Aged*	252	229	225	204

* 24 hours at 212° F.

illustrate the effect of adding 40 and 60-phr. of hard clay to a 60-phr. Hi-Sil 233 loaded carboxylic compound, both with and without the added acceleration. Of these, Compound 13 was selected for inclusion in the suggested best recipes in Table 1.

The use of a high styrene resin, Marbon 8000, in connection with the carboxylic polymer was also investigated. Compounds 14 through 16, Table 3, show that it increased hardness, but reduced tensile strength and had an adverse effect on abrasion resistance. Since the desired hardness can be obtained more cheaply by other means, it does not appear that high styrene resin is particularly useful in this application.

Carboxylic and Nitrile Rubbers

The carboxylic polymer, Hycar 1072, is approximately 30% more costly than the ordinary nitrile copolymers. It was desirable, therefore, to find out if

the properties required for this top lift could be obtained with a blend of the two rubbers which would be cheaper than the carboxylic rubber alone. The results of this investigation are shown in Table 4.

In working with these blends, it is still necessary to leave the zinc oxide out until the batch is otherwise complete to avoid scorching.

Comparison of Compound 8 with 17, 9 with 20, and 11 with 22 shows that the blend of rubbers requires more acceleration or activation. Taking this into account, two compounds were developed which had the required abrasion resistance. One of these (21) loaded with 60 phr. of Hi-Sil 233 was below the required hardness. The addition of 40 phr. of hard clay (Compound 23) brought the Shore D hardness up five points without reducing the abrasion index below the 150 minimum which was sought.

Inclusion of high styrene resin in the blend of

TABLE 7. SBR AND PHENOLIC RESIN BLEND PROPERTIES

Compound	33	34	35	36
SBR 1502	80	80	80	80
Marbon 8000	20	20	20	20
Durez 13355	10	10	10	10
Hi-Sil 233	90	80	70	60
Zinc oxide	5	5	5	5
MBTS	2	2	2	2
DOTG	0.5	0.5	0.5	0.5
Sulfur	4	4	4	4
100° C. m.p. Coumarone	10	10	10	10
Triethanolamine	3	3	3	3
Stearic acid	3	3	3	3

Min. cure @ 320° F.

M	in. cure @ 320°.	F.			
	Mod	ulus at 100% l	Elongatio	n, Psi.	
4		770	840	860	910
8		1130	1110	1070	1060
12		1240	1260	1160	1090
16		1320	1290	1210	1140
		Tensile Stren	gth, Psi.		
4		2670	2800	2950	2830
8		2900	2850	2770	2630
12		2970	2960	2800	2630
16		2950	2940	2820	2640
		Elongatio	n, %		
4		480	420	440	410
8		350	330	360	340
12		320	310	330	320
16		280	290	320	320
		Shore D Ha	rdness		
4		56	53	53	52
8		58	54	55	52
12		59	57	57	53
16		61	57	58	53
	T	ear Resistance	e, Lbs/In		
4		500	510	550	430
8		550	490	510	430
12		570	480	500	430
16		530	470	460	420
	NBS Abrasio	on Index, % C	ompared	to Contro	ol B
12	Unaged	69	65	53	57
	Agad*	65	67	40	50

^{* 24} hours at 212° F.

carboxylic rubber and NBR also raised hardness, but had a more drastic effect than the clay on tensile strength and abrasion resistance. This can be seen by comparing Compounds 20, 22, and 24 in Table 4 on carboxylic NBR blends.

Carboxylic and Styrene-Butadiene Rubbers

It was evident that an even greater cost saving could be made if the expensive carboxylic rubber could be diluted with SBR. Using this type of blend, it was necessary to increase the Hi-Sil 233 loading to 80 phr. to obtain desired hardness and abrasion resistance. Use of clay to get the necessary hardness reduced abrasion resistance far below the required figure. This result is apparent by observing compounds 25, 26, and 27 in Table 5. High styrene resin had much less effect than clay on abrasion index of this type of blend (compare 27 and 28), but it was still more than desirable

The compound (25) containing an 80 phr. Hi-Sil 233 loading did meet all of the customer's requirements and was included, therefore, in the suggested recipes in Table 1.

In working with blends of carboxylic rubber with SBR it is emphasized once again that zinc oxide must be held out until the final processing operation in order to avoid scorch.

Phenolic Resins and Synthetic Rubbers

Several satisfactory compounds were made by incorporating fairly large quantities of a phenolic resin in NBR loaded with Hi-Sil 233. The pigment loading was varied from 50 to 80 parts, as shown in Table 6, with only relatively minor differences in hardness and abrasion resistance. A compound (31) containing a 60-phr. loading was chosen for inclusion in Table 1 because it would be somewhat easier to mix than the more highly loaded stocks.

Another phenolic resin recommended for use in SBR was tested in several compounds based on SBR rubber plus high styrene resin. Although satisfactory hardness was achieved, none of the stocks had a sufficiently high abrasion index for the purpose required. These stocks may be useful for other purposes and are shown in Table 7 as a matter of general interest to compounders.

Summary and Conclusions

At least one shoe industry firm has new requirements for ladies' non-marking top lifts with minimum NBS abrasion index of 150 and Shore D hardness of 52 to 55 for such top lifts.

These unusually severe requirements can be met in two ways, both of which depend on use of Hi-Sil 233 as the reinforcing pigment. In one case, a carboxylic modified nitrile rubber is used either alone or in combination with more common synthetic rubbers. In the other case, a relatively high amount of phenolic resin is used with a nitrile rubber reinforced with fine particle size hydrated silica.

NEWS of the

RUBBER WORL

The Special Stockpile Advisory Committee report of January 28 has produced opinions on both sides as to whether the report would support a move by the Office of Defense Mobilization toward partial liquidation of the 1.25-million-ton natural rubber stockpile. A final decision will depend on a vote of government departments directly concerned with stockpiling.

Federal Trade Commission hearings during March will be concerned with an FTC complaint against Firestone on tire advertising and another complaint against Thermoid on price discrimination.

The Treasury Department has agreed not to reduce tariffs on certain rubber products previously slated for considerable reduction.

Reciprocal Trade Agreements Act five-year extension seems likely to be limited to an extension of from two to three years.

A Rubber Shippers Association is being formed by the traffic committee of The Rubber Manufacturers Association, Inc., to combat mounting freight costs and to make lower volume rates available to all manufacturers who have occasion to ship products in less-than-carload lots.

Ozone and ozone cracking of rubber products were discussed and brought up-to-date at a symposium at the meeting of Committee D-ll on Rubber of the American Society for Testing Materials in St. Louis on February 10. "The New Science of Materials" was described by a vice president of Monsanto Chemical Co., C. S. Hochwalt, at this same meeting.

H. E. Humphreys, Jr., chairman of the board, United States Rubber Co., explained six ways the rubber industry contributes to the nation's strength; R. P. Dinsmore, vice president, Goodyear Tire & Rubber Co., described recent developments in tires for today's cars; and Allen V. Astin, director of the National Bureau of Standards, emphasized the importance of fundamental research and technological competition at the special tenth anniversary meeting of the Washington Rubber Group on February 18.

Quality control, its organization for rubber and chemical products and processes, was the subject of a recent Akron Rubber Group panel discussion. The German Rubber Society's 1958 Rubber Conference in Cologne, Germany, May 7-10, will include nine papers from the U.S.A. and Canada out of a total of 37 to be presented.



MEETINGS

and REPORTS

ASTM Committee Week Luncheon, Ozone Symposium, D-11 Report

Committee Week of the American Society for Testing Materials was held in St. Louis, Mo., February 9-14. Of particular interest to the rubber, plastics, and chemical industry members were the Committee D-11 symposium of eight papers on "Ozone Problems," the Chemical Industry Luncheon sponsored by Committees D-11 on rubber and D-24 on Carbon Black, and the meetings of Committee D-11 and its subcommittees and Committee D-24 and its subcommittees

The very interesting and informative symposium on "Ozone Problems" will be published by the Society. Abstracts of the papers presented and other information are included in our report. Some of the highlights of the talk by C. S. Hochwalt, vice president, Monsanto Chemical Co., at the Chemical Industries Luncheon are recounted. Details of the actions of the various D-11 subcommittees and those of Committee D-11 and its advisory committee are also presented, as has been our custom for several years. A report of meetings of Committee D-24 and its subcommittees will be presented at a later date.

"The New Science of Materials"

The subject of Dr. Hochwalt's talk at the Chemical Industries Luncheon was "Standards and the New Science of Materials." Monsanto Chemical Co., founded in 1901 by business men and chemists, had the manufacture of chemical products as its initial goal. It was not until 1938 that Monsanto got into the manufacture of high polymers and plastics, and it was at that time Monsanto's and ASTM's paths converged and have remained intermingled ever since, Dr. Hochwalt said.

ASTM and its member participants, Monsanto included, stand on the threshold of a new era which will bring greater changes than any we have seen before, and which will reshuffle our technologies at a rate of speed which will be terrifying if we are not braced for it, he warned. This era is being brought into being by what the speaker called the new science of materials. The creation, testing, application, and under-

devoted primarily to the research aspects of the problem. To meet the new needs, standards are going to have to define fundamental properties, not secondary characteristics. Perhaps the target of tomorrow's standard should be an equation of state or, perhaps, equations of state. Into an equation of this nature will go the molecular and atomic parameters of a given composition of matter.

In conclusion, Dr. Hochwalt reemphasized that we stand on the threshold of a new science of materials which will profoundly affect ASTM, as well as the chemical and allied industries, and will require a new approach to standardization if the Society is to continue its eminent position in this area.



Ozone symposium authors, ASTM staff, and Committee D-11 officers

standing of these new materials, methods, and procedures comprise the new science of materials. It brings with it new skills, new talents, new viewpoints—even a whole new language. New metals, new combinations, new synthetic materials, all combined and recombined in new ways make possible new devices and new effects.

In the new science of materials we are dealing in molecular, atomic, and sub-atomic phenomena, and it is the understanding of these—and their manipulation to meet our new needs—that distinguishes this area as a radical new development in materials technology. It is with these that the ASTM committee work of the future will be most deeply concerned, and to adapt quickly to this new situation is the greatest challenge confronting this Society, in the opinion of Dr. Hochwalt.

We are going to need new kinds of standards, and we are going to have to produce them promptly, the speaker added. To keep abreast, standards are needed for the materials of today—not for those of yesterday. One rather obvious way to develop standards at a faster pace is to put more people to work on a full rather than a parttime basis. This means a greater financial commitment by producer, consumer, and general interest members of the Society, and this commitment should be

Ozone Symposium

Simon Collier, Johns-Manville Corp., chairman of Committee D-11, opened the symposium and then turned this special program over to G. C. Maassen, R. T. Vanderbilt Co., who was chairman of the program committee for this symposium on ozone aging. Other members of this program committee were A. E. Juve, B. F. Goodrich Co.; Z. T. Ossefort, Rock Island Arsenal; and George Wilson, ASTM headquarters staff

Mr. Maassen referred to pioneering work done since 1926 by leading rubber technologists both in the United States and abroad in connection with ozone and its effect on rubber. He added that interest by the Federal Government and the automobile industry in storage deterioration of rubber products such as tires had probably done more than anything else to accelerate research and development work on means of protecting rubber products from ozone deterioration. Papers presented at the symposium should be representative of the most recent knowledge in the field of ozone and ozone aging effects on rubber and will be published by ASTM, he said.

Abstracts of the papers given at the symposium are presented on the following pages.

"Rubber and Its Environment," by A. J. Haagen-Smit, California Institute of Technology, Pasadena, Calif.

The most bothersome problems with rubber products are associated with their deterioration due to sunlight, and their failure due to atmospheric constituents-ozone and oxygen, and atmospheric pollutants such as oxides of nitrogen.

Sunlight attacks rubber stocks, developing a non-tacky surface covered with minute, shallow cracks unlike those of ozone. Oxygen in the air slowly attacks stretched or unstretched rubber, destroying its useful properties of elasticity, tensile strength, and wear resistance. Oxygen does not, however, develop the characteristic cracking effects of ozone, which is evidenced by knife-like cuts which leave the rubber between the cracks unaffected. In severe cases these ozone cuts penetrate deeply, causing serious damage to the rubber products. Ozone cracks rubber only when the rubber is under strain. We distinguish two types of ozone cracking as follows: (1) static, where there is stretching, but no flexing action, as in automobile windshield seals; (2) dynamic, where both stretching and flexing occur, as in tires in service.

Ozone is a natural constituent of the air and is formed from oxygen through the action of ultra-violet rays from the sun. The formation takes place about 20 miles above the earth's surface, and there its concentration is in the order of two parts per million. Through diffusion and turbulence some of the ozone comes down to us, and this is the ozone which is measured in non-polluted areas at 0.03- to 0.04-part per million.

In cities, ozone is often absent or very low because the very reactive ozone finds many substances capable of removing it from the air. It was, therefore, very surprising that the deterioration of rubber goods in the Los Angeles area was exceptionally fast and resembled closely that caused by abnormally high ozone concentration. We have established that this ozone is not coming down from the upper atmosphere, but is due to a photochemical oxidation of organic material by sunlight in the presence of oxides of nitrogen. This is the same chemical reaction which is responsible for the Los Angeles smog and which has made its appearance in other major metropolitan areas in recent years.

Engineering development and research are presently under way to reduce these obnoxious materials which generate ozone; however, before these studies are converted into practical methods, and before the public and industry are willing to bear the cost, many years may go by. It is therefore important to take measures during this intervening time to minimize ozone damage and nuisance as much as possible.

Some of these means consist of the use of additives to rubber. Other

methods prevent the ready access of the reaction to the rubber surface. In recent years great progress has been made in the perfection of these methods. Revolutionary changes in operating requirements and even changes in our atmosphere require constant alertness, however, if the rubber industry is to cope with the problems of modern living.

"A Study of the Reaction of Ozone with Polybutadiene Rubbers," by E. R. Erickson, Augustana Research Founda-

All styrene-butadiene rubber (SBR) vulcanizates, when tested in a relaxed state, reacted with ozone (25 to 500 pphm. ozone in air) to form a film of oxidized products which provided an effective barrier against attack.

SBR vulcanizates which were under stress, but which contained no effective antiozonant in their formulation, were readily attacked. The absorption of ozone began with an initial rate of zero which rapidly increased until some maximum rate had been reached when ozone cracks became visible on the surface of the vulcanizate.

SBR vulcanizates which were under stress, but which contained an antiozonant, absorbed ozone with a high initial rate, which depended on the concentration of the ozone-sensitive materials on the surface of the vulcanizate and on the partial pressure of the gaseous ozone. The rate of absorption declined during the exposure time until a steady low equilibrium rate was reached. The vulcanizates were protected from an attack by ozone (cracking) to a degree which ranged from poor to excellent. The degree of protection depended on (1) the differential in the rates of reaction of the antiozonant with ozone and the rubber hydrocarbon with ozone; (2) the initial concentration of the antiozonant on the surface of the vulcanizate; and (3) the rate of effusion of fresh antiozonant from within the rubber to the outer surface of the oxidized barrier.

A mechanism is proposed for the protective action of antiozonants in vulcanizates, and a rate equation has been derived from this mechanism which is consistent with the experimental data.

"The Reaction of Ozone with Rubber," by Harold Tucker, Goodrich, Brecksville, O.

The reaction of ozone with natural rubber and neoprene was examined by using open-cell sponge. In each case the initial rate of adsorption was very high and decreased with the adsorption of ozone. Under conditions of very high humidity, however, there was no falling off in the rate of ozone up-take. The sponge was extracted with acetone, and the products were examined.

A similar pattern was obtained on solid SBR in a tread-type recipe. Here, as the sample was elongated, the amount of ozone adsorbed increased

until a strain of about 40% was reached. Under the conditions of the test the ozone up-take reached a constant value at this point.

The mechanism of cracking rubber by ozone is postulated to be by modification of the rubber structure by ozone to yield a material with low elongation. Cracks then develop by failure in tension of this modified rubber. Cracks typical of ozone cracking were produced by curing the surface of rubber compounds much tighter than the in-

"Ozone Resistance of Elastomeric Vulcanizates," by Z. T. Ossefort, Rock Island Arsenal, Rock Island, Ill.1

There has been a growing need of ozone-resistant elastomeric vulcanizates for military and civilian purposes, and this need has been accentuated by the problems encountered with such vulcanizates that have not had sufficient ozone resistance. The increased use of synthetic rubbers and highly plasticized rubbers and the higher atmospheric ozone content in certain metropolitan areas of the country have added to the seriousness of the problem of providing rubber products with adequate resistance to ozone deterioration.

Factors affecting ozone resistance of rubber and rubber products are many and varied. Among these are polymer type and degree of unsaturation, state of cure, plasticizer content, filler content, the degree of stress applied to the product, edge effects, temperature as related to wax solubility and diffusion to surface, whether service conditions are static or dynamic, and the ozone concentration to which the product is exposed.

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Ozone resistance may be obtained by many different means. Polymers with limited unsaturation are, of course, more resistant than those with higher unsaturation; proper compounding with waxes and antiozonants is necessary, and a physical barrier on the surface of the product provided by flexible films of certain plastics or even of paper or a reactive film of antiozonant in solvent will add to the ozone resistance.

Commercial elastomeric vulcanizates may be classified as follows: (1) those that are inherently ozone resistant; (2) those that are ozone resistant if properly compounded even though antiozonant is absent; (3) those that are ozone resistant if they have been properly compounded with antiozonant in the formulation.

The broad scope of the problem and the many test variables, commercial materials, cost, extent of the storage required, and the compound recipes available, necessitate careful study of individual needs or requirements in order to arrive at an optimum vulcanizate for the intended purpose, it was concluded.

¹ See also RUBBER WORLD, Aug., 1954, p. 636.

"Prevention of Ozone Attack on Rubber by Use of Waxes," by S. W. Ferris, S. S. Kurtz, Jr., and J. S. Sweeley, Sun Oil Co., Marcus Hook, Pa.

Addition of the proper amount and type of petroleum wax to rubber will protect it from ozone checking during outdoor exposure. The wax blooms to the surface and forms a film; the degree of protection afforded depends upon the tenacity with which the wax crystals adhere to the rubber and upon the manner in which the crystals pack together to form the layer.

Proper evaluation of anti-checking waxes requires testing of the vulcanizates in ozone cabinets, with confirmatory outdoor exposure tests.

Some rubbers are more easily protected than others, and with the same rubber some waxes are much more effective than others. The performance of a wax depends upon its chemical composition, and although two waxes of widely different composition may each provide good protection, very minor changes in composition of either may seriously impair its anti-checking powers.

Tailoring of an anti-checking wax therefore involves extensive laboratory and field testing to select the proper wax, and at the same time, rigid control of the manufacturing processes in order to maintain the same wax composition.

"Comparison of Accelerated and Natural Tests for Ozone Resistance of Elastomers," by G. N. Vacca, Bell Telephone Laboratories, Inc., Murray Hill, N. J.²

A major difficulty in making comparisons between natural and accelerated tests for ozone resistance of elastomers arises from the fact that widely varying results can be obtained in natural tests. Location of the test site as well as season of the year will influence results especially in stocks having borderline resistance. Another difficulty is duration of the natural test. While a month or two may be adequate to screen out stocks with moderate ozone resistance, longer periods are required for the more resistant stocks. With stocks made from polymers inherently resistant to ozone, which contain a light screening material such as carbon black, correlation of results obtained in natural and accelerated tests is very good.

Ozone concentration and temperature are accurately controlled in the accelerated test. Ozone cabinets in use by the industry and type specimens used are described. In the natural test, however, not only do ozone concentration and temperature vary widely, but sunlight and rainfall are also involved.

All of these factors undoubtedly affect the rate of ozone attack, and it may be that complete correlation will seldom be obtained.

"Chemical Antiozonants and Factors Affecting Their Utility," by W. L. Cox, Universal Oil Products Co., Des Plaines, Ill.

While many materials show some antiozonant effectiveness, the most effective materials reported to date are the N, N'-di-sec. alkyl-p-phenylenediamines. These materials, which are more than 200 times as reactive toward ozone as is the double bond in SBR, appear to function chiefly as ozone scavengers, reacting with the atmospheric ozone before it can attack the rubber.

The ozone resistance imparted to any one polymer by a particular antiozonant will depend upon the structure of the polymer, the antiozonant concentration, the nature and amount of reinforcing agent, the curing system selected, and the presence or absence of waxes and processing oils.

Similarly, the antiozonant requirement of any given stock will depend upon the geometry and the conditioning of the sample, and the nature of the test—including strain, ozone concentration, temperature, and whether the test is made under static or dynamic conditions.

Only when due consideration is given to all these factors can the maximum results from chemical antiozonants be achieved and the extension of crack-free life of the rubber article from hours to years.

"Quantitative Measurement of Rate of Ozone Cracking," by A. G. Veith, Goodrich, Brecksville.

There is a movement under way to correct the deficiencies of the present ASTM D 1149-55T, Method of Test for Accelerated Ozone Cracking of Vulcanized Rubber. The deficiencies of this method are (a) the lack of sufficient air throughput rate and circulation in the presently specified chamber and (b) difficulties encountered in the analysis of ozone. A new chamber and countercurrent ozone adsorption column that avoid the above-mentioned shortcomings are described.

As part of a program to obtain basic information on the phenomenon of ozone cracking, some preliminary results on the ozone induced creep of gum vulcanizates are reported. The creep rate has been expressed in terms of the initial rate of cross-sectional area decrease due to ozone cracking. This rate is a measure of the collective growth of ozone cracks. An "absolute' rate of cross-sectional area decrease can be obtained independent of sample geometry. For practical reasons an approximate "absolute" rate is used where sample geometry is maintained essentially constant.

The rate of cross-sectional area de-

crease is linearly related to the reciprocal degree of orientation of the network chains, $(\lambda_o F)^{-1}$. The logarithm of the induction period is also linear with $(\lambda_o F)^{-1}$. Explanations for this particular dependence are offered. The rate of crack growth and the induction period for a series of common polymers were measured. Both parameters placed the polymers in the order that experience would indicate and lend confidence to the creep technique.

Mr. Veith also gave a report on an interlaboratory ozone test program before subcommittee 15 of Committee D-11. This report was considered to be of such significance that Committee D-11 voted to include it as part of the eventual publication of this symposium. A summary of this second paper of Mr. Veith is therefore presented herewith.

"Report on Interlaboratory Ozone Test Program of ASTM D-11 Subcommittee 15—1957," by A. G. Veith.

A program to determine the magnitude of interlaboratory variation in accelerated ozone testing has been planned and carried out by the ozone test section of subcommittee 15 of typical styrene-butadiene rubber (SBR), neoprene rubber (CR), and butyl rubber (IIR) formulations were mixed and cured at one laboratory and sent out to be tested for specified conditions of ozone concentration, temperature, exposure time, air changes, and sample type.

The relaxed exposed samples were returned to the Goodrich Research Center laboratory for evaluation. A technique for measuring the mean crack length was developed, and evidence presented to show that this parameter reliably reflects the degree of cracking or extent of attack due to ozone under the conditions of these tests. Two different ozone chambers, the Bush³ and the Mast,⁴ were included in the test program.

Statistical analysis of the data yielded the following information: A significant difference between crack length, L, for Run 1 versus Run 2 was found for CR. In most laboratories Run 2 was greater than Run 1. A hint of similar behavior was exhibited for SBR and IIR although further data would be necessary for a firm decision. A tentative reason for result has been proposed.

Using the differences between runs as an estimate of within-laboratory variance a comparison was made of this variance to the between-laboratory variance. The two estimated variances were not significantly different, which indicates that a great amount of variation exists in each laboratory, and that further work will be needed in each laboratory to improve chamber performance.

Statistical analysis also showed that the variances associated with the operation of both chambers, i.e., Bush and

² Ibid., Feb., 1957, p. 699.

G. F. Bush Associates, Princeton, N. J.

Mast Development Co., Inc., Daven-

Mast, were equivalent. The grand mean average crack length for Bush versus Mast chambers for CR and IIR, however, was not equivalent. A significantly higher value was associated with the Mast chamber. This result may be due to less efficient air circulation in the Bush chamber.

The overall picture is one of encouragement. This agreement between laboratories is considered to be good for a test such as this, which is admittedly one given to rather large variations. The degree of agreement between the participating laboratories is about equal to what could be expected in other phases of interlaboratory testing of rubber and rubber products.

D-11 Meeting

The advisory committee of ASTM Committee D-11 on Rubber and Rubber-Like Materials met on February 9, and the main committee on February 12. Simon Collier, chairman of D-11, presided at both of the meetings, assisted by J. J. Allen, Firestone Tire & Rubber Co., D-11 secretary.

Committee D-11 recommended to the Society that the "ASTM Standards on Rubber Products" handbook be published again in June, 1958, and then republished every two years thereafter.

The next meeting of Committee D-11 will be held at the time of the annual meeting of the Society in Boston, Mass., at the Hotel Statler. D-11 and its subcommittees will meet on June 25, 26, and 27.

It was agreed that the secretary should request an annual contribution of \$2 from all those on the D-11 mailing list in order to provide funds for future work of the Committee.

Committee D-11 will not meet with the Society in San Francisco, Calif... October, 1959, because of the participation in the meeting of the International Standards Organization, Technical Committee 45 on Rubber, which is scheduled for New York in October.

L. V. Cooper, Firestone, reported on his assignment in connection with possible revision of the scope of Committee D-11. It was decided that the present scope would not be changed. The D-11 scope thus remains: "Formulation of specifications, methods of test, and definitions of terms pertaining to rubber and rubber-like materials, the compounding ingredients used therein and the products therefrom, including research concerning the properties of such materials and products.

Proposed definitions for "rubber-like materials" and "vulcanization" as presented by H. G. Bimmerman, E. I. du Pont de Nemours & Co., Inc., are to be given to subcommittees 8 on nomenclature for its consideration and possible adoption as revisions in the "Glossary of Terms Relating to Rubber and Rubber-Like Materials," and as

"Tentative Recommended Practice for Nomenclature for Elastomers.

It was recommended that a task group on the calibration of mechanical tension testing machines with representation from Committees D-6 on Paper and Paper Products, D-11 on Rubber, D-13 on Textiles, D-20 on Plastics, and E-1 on Methods of Testing, be formed to develop improved methods of calibrating such machines.

Mr. Cooper was appointed chairman of the D-11 nominating committee.

Subcommittee Meetings

Subcommittee 5-Insulated Wire and Cable. John T. Blake, Simplex Wire & Cable Co., chairman. It was voted to submit the following changes to a retroactive letter-ballot in Committee D-11 so that, if approved, the next printing of the handbook, "ASTM Standards on Rubber Products," of Committee D-11 scheduled for June, 1958, will include these changes in certain standards: (1) A revision of Tables 1 and 2 in D 1350-56T, Specification for Construction of Rubber Insulated Wire and Cable. (2) New specification for an insulation on a conductor operating at 90°/C. (3) Limiting the insulations to service up to 2000 volts in D 27-54T, Specification for Natural Rubber AO Insulation for Wire and Cable; D 353-54T, Specification for Natural Rubber Performance Insulation for Wire and Cable: D 469-54T, Specification for Natural Rubber Heat-Resisting Insulation for Wire and Cable; D 754-54T, Specification for Synthetic Rubber Heat-Resisting Insulation for Wire and Cable: and D 755-54T, Specification for Synthetic Rubber Performance Insulation for Wire and Cable.

It was also voted to recommend the following tentative specifications for advancement to standard: D 27-54T; D 353-54T; D 469-54T; D 532-54T. Specification for Natural Rubber Sheath for Wire and Cable: D 574-54T, Specification for Ozone-Resisting Insulation for Wire and Cable: D 754-54T: D 755-54T; and D 866-54T. Specification for Styrene-Butadiene (SBR) Synthetic Rubber Sheath for Wire and Cable.

There was much discussion of the scope of the assignment of subcommittee 5, and a modification of the present scope will be proposed in the

near future.

Subcommittee 6-Packings, R. F. Anderson, The B. F. Goodrich Co., chairman. Tentative standards under the jurisdiction of the subcommittee were reviewed, and the following recommendations made:

(1) D 1081-49T, Method of Test for Evaluating Pressure-Sealing Properties of Rubber and Rubber-Like Materials. to remain as a tentative standard in view of the development of a modified test procedure by the U.S. Navy, Bureau of Ships.

(2) D 1147-56T, Method of Test for

Compressibility and Recovery of Gasket Materials, to remain as a tentative standard. A working group was assigned to revise Table 1 of this method so that it will conform to the description of materials and conditioning procedures established by D 1170-54T, Specification for Non-Metallic Gasket Material Purposes. This revision will be letter-balloted in the subcommittee.

(3) D 1330-55T, Specification for Sheet Rubber Packing is also to remain as a tentative standard because of the limited use of this specification. On line 1 of Table 1 of this method the "16" is to be changed to "in."

The subcommittee chairman will investigate the introduction of a footnote in D 1081-49T to indicate the source of seal aging jigs mentioned in this method.

It was agreed that the present scope of subcommittee 6 which reads: "Development of specifications and methods of test applicable to packings."

should remain as stated.

Reports were made on the status of the round-robin tests on stress relaxation in Section 10C of SAE-ASTM Technical Committee on Automotive Rubber, and on the work on sealability in the same section of Tech. A. A working group on corrosion has also been appointed by this same section and will meet in Detroit to study the possibilities of developing a corrosion procedure for gasketing material.

It was reported that the U.S. Navy will issue a specification for O-rings that will include a stress relaxation requirement.

Subcommittee 8-Nomenclature and Definitions. R. G. Seaman, RUBBER WORLD, chairman. L. V. Cooper, Firestone Tire & Rubber Co., presented definitions for "rubber-like materials" and for "vulcanization" as revisions of the definitions in the present ASTM Special Technical Publication No. 184. Glossary of Terms Relating to Rubber and Rubber-Like Materials," and for eventual adoption as Tentative Recommended Practice for Nomenclature for Elastomers. These definitions are as follows:

"A rubber-like material is one which in the normally compounded state and vulcanized or polymerized produces a product with elastic characteristics which will recover its original size and shape within 5% in less than 3 seconds when compressed to 34 of its original thickness for 5 seconds and released, or elongated to double its length for 5 seconds and released."

"Vulcanization is a reaction in which the physical properties of an elastomer are changed in the direction of decreased plastic flow and increased

ISO/TC 45 Draft Recommendations Nos. 48-53 of ISO/TC 45 Working Group 5 on Terminology, as reviewed

and approved with minor modifications by subcommittee 8 at the June, 1957, meeting of ASTM Committee D-11, are also recommended for adoption as Tentative Recommended Practice for Nomenclature for Elastomers. These definitions are given below:

"Abrasion resistance index is a measure of the abrasion resistance of a natural or synthetic rubber relative to that of a standard rubber under specified conditions and expressed as S/T x 100, where S is the volume loss of a standard rubber, and T is the volume loss of the rubber under test."

"Tear strength is the maximum load in pounds per inch of thickness of a specified test specimen, the load acting in a direction substantially parallel to the major axis of the test specimen."

"Hardness is resistance to indentation."

"International rubber hardness degrees is a measure of hardness, the magnitude of which is derived from the depth of penetration of a specified indentor into a test specimen under specified conditions. The scale is so chosen that 0 degrees would represent a material showing no measureable resistance to indentation, and 100 degrees would represent a material showing no measureable indentation. The scale is completely described in ISO/TC 45 Draft Recommendation No. 50."

"Mechanical stability of latices is resistance to clotting of latex when subjected to mechanical shear under specified conditions."

"Grain is uni-directional orientation of rubber or filler particles resulting in anistrophy of a material."

"Swelling is the increase in volume or linear dimensions of a test specimen immersed in a liquid or exposed to a vapor."

"Tensile stress is the stress applied so as to stretch the test specimen: numerically it is the applied load divided by the area of initial cross-section."

"Tensile stress at a given elongation is the tensile stress required to stretch the tensile specimen from an initial condition to a given elongation."

'Tensile strength is the maximum tensile stress applied uniformly over the cross-section of the test specimen in the course of stretching the test specimen to rupture."

"Test specimen is a piece of material appropriately shaped and prepared so that it is ready to use in a physical test."

Subcommittee 8 recommends that all of these definitions be submitted to letter-ballot in Committee D-11 for adoption as Tentative Recommended Practice for Nomenclature for Elastomers.

Subcommittee 9—Insulating Tape. C. W. Pickells, Consolidated Edison Co.

of New York, chairman. The subcommittee chairman reported that the latest revised versions of D 69-57T, Friction Tape for General Use for Electrical Purposes; D 119-57T, Rubber Insulating Tape; and D 1373-57T, Ozone Resistant Rubber Insulating Tape, have been published in the 1957 Supplement to the "Book of ASTM Standards."

Suggested revisions by the test and specifications sections of the subcommittee will be letter-balloted in the subcommittee.

A report of the task group working on specifications for moisture in rubber tapes indicated that test results from several laboratories on the moisture content of various rubber and ozone-resistant tapes will be available and submitted with a progress report at the June meeting. The objective of this work is to write a separate moisture-resistance requirement specification rather than add a moisture specification to present tape standards.

A proposal to increase the ozone concentration used in the test in D 1373-57T from 0.010-0.015% by volume to 0.025-0.030% by volume was defeated. If tape requiring resistance to ozone of higher than the presently indicated amount is required, a separate specification will be written.

Subcommittee 10—Physical Testing. L. V. Cooper, chairman. A. E. Juve. Goodrich, chairman of a task group, presented an excellent report on the determination of equivalent cures in specimens of various shapes, and the report was considered to be of such immediate value that the chairman of the subcommittee was instructed to see that it was published as widely as possible in the near future.

The report of the task group headed by R. F. Tener, National Bureau of Standards, which had been working on the tension testing of O-rings, was given. It has been determined that the type of grip used for testing any ring specimen is not important if castor oil or other suitable lubricant is used between specimen and grip. The subcommittee voted for the elimination of D 1414-56T, Method of Tension Testing of O-Rings, and asked that the necessary editorial changes be made in D 412-51T. Method of Tension Testing of Vulcanized Rubber, so as to include properly the testing of O-rings in the paragraph on the testing of ring specimens.

The task group headed by D. C. Scott, Jr., Scott Testers, Inc., reported that much conflicting data had been obtained in connection with his assignment to revise the calibration method for tension testing machines. The D-11 advisory committee had suggested that the chairman of subcommittee 10 present this problem to Committee E-1 on Methods of Testing, Subcommittee 1 on calibration of mechanical testing machines and apparatus. The chairman of

E-1 subcommittee 1 requested that D-11 subcommittee 10 present its problem in writing and recommended subcommittee 10 members who would cooperate with members from Committees D-6 on Paper and Paper Products, Committee D-13 on Textile Materials, Committee D-20 on Plastics, and Committee E-1 in formulating a possible improved method of calibration. Subcommittee 10 recommended to D-11 that Mr. Scott and Howard Tangenberg, Goodrich, be appointed to represent D-11 on this intercommittee task group on tension testing machine calibration.

Subcommittee 11—Chemical Analysis. W. P. Tyler, Goodrich, chairman. Two methods of test for rubber chemicals are currently being studied by a task group headed by G. C. Maassen, R. T. Vanderbilt Co. A proposed method for the determination of solubility was returned to the task group for editorial revision.

A task group will make a study of the method for the determination of copper in rubber, in D 297-57T, Methods for Chemical Analysis of Rubber Products, and proposed changes aimed at bringing the ASTM method in line with the ISO/TC 45 method, before submitting these changes to letterballot. A progress report on an investigation of two methods for the determination of sulfur was presented. Both methods look promising, but more study is required before they can be considered for standardization.

Work is being continued on a method for the determination of zinc and on the rapid reflux extraction method.

Subcommittee 12-Crude Natural Rubber, N. Bekkedahl, NBS, chairman. R. D. Stiehler, NBS, reported on the ISO/TC 45 meeting of September. 1957, in Zurich, Switzerland. Subcommittee 12 recommends that ASTM accept ISO/TC 45 procedures for sampling, volatile matter, ash, copper, manganese, dirt, and rubber hydrocarbon content of crude natural rubber. It is also recommended that these methods, along with present ASTM methods for acetone soluble materials and iron. be submitted to letter-ballot in Committee D-11, and that these methods be placed under a single designation entitled. "Methods of Chemical Analysis Natural Rubber." The present D 1278-53T, Methods of Test for Harmful Dirt in Crude Natural Rubber, is no longer necessary, and it is recommended that it be withdrawn.

Subcommittee 12 will investigate rapid methods for the determination of the deterioration of crude natural rubber, physical test methods, compounding, etc.

Dr. Stiehler reported the availability of standard samples of crude natural rubber from NBS.

Subcommittee 13—Synthetic Elastomers. B. S. Garvey, Jr., Pennsalt Chemicals Corp., chairman. New numbers assigned to styrene-butadiene rubbers (SBR) and latices between June, 1957, and January, 1958, have been published in RUBBER WORLD and Rubber Age and approved by letter-ballot in Committee D-11.

Section 1 on sampling, headed by L. G. Mason, Goodrich, reported that nothing will be done for the present on a method of sampling for testing for mill shrinkage. Work will continue on methods of sampling for SBR oil and

black masterbatches

Section 2 on chemical tests for SBR, headed by B. C. Pryor, Goodrich-Gulf Chemicals, Inc., reported that the method of ethanol-toluene azeotrope extract had been approved by letter-ballot in Committee D-11. The method for the determination of mixed alkylated phenol antioxidant in SBR is recommended for letter-ballot in D-11 for adoption as a tentative standard. Methods for the determination of oil content and total extract in dry SBR will be developed and submitted to letter-ballot in the subcommittee. Methods for the determination of antioxidant in SBR oil masterbatches will also be considered. It was explained that the present mill method for moisture or volatile matter is used in the SBR producing plants: the oven method is used when the rubber is too soft for the mill method, and the azeotropic distillation method is not used by the producing plants.

Section 3, as reconstituted, is headed by W. G. Orr, Texus-U. S. Chemical Co., plus W. M. Otto, Firestone, and A. R. Baker, Copolymer Rubber & Chemical Co. A survey of SBR producers with regard to the compound recipe being used to test each type of polymer is to be made. The use of HAF black in place of EPC black for testing oil masterbatches seems to be favored, and the use of the laboratory Banbury mixer as an alternate for mill mixing will be considered as soon as data are

available.

Section 3 members were designated as representatives of subcommittee 13 on a task group with members from subcommittee 29 on compounding ingredients, which is considering the desirability of removing the compound recipes for the physical testing of SBR from D 15-57T, Method of Sample Preparation for Physical Tests of Rubber Products, and including these recipes in a separate tentative standard.

A cross-check on the NBS standard bale No. 386A of SBR by the producing plant laboratories will be made. Mr. Orr will arrange for a blend of 500 pounds of NBS No. 386A for use by the SBR producers for a cross-check of chemical tests. NBS certifies physical test results only on SBR standard bales.

Section 4 on test methods for synthetic latices reported that no new methods were being considered, but the section will be continued subject to call as needed.

Section 5 on nomenclature headed by

Mr. Seaman reported that the D-11 letter ballot on the adoption of "Si" to designate in D 1418-56T, Recommended Practice for Nomenclature for Synthetic Elastomers and Latices, the silicone family of elastomers resulted in 113 affirmative and two negative votes. Although attempts to resolve the two negative votes had not been successful, section 5 recommended that the "Si" term be adopted since the reasons for the negative votes were not considered sufficient for withdrawal of the term. Section 5 was discharged since matters of nomenclature for synthetic elastomers can be referred to subcommittee 8.

A vote of appreciation and thanks to the editors of RUBBER WORLD and Rubber Age from subcommittee 13 for publication of D 1418-56T nomenclature and the new SBR numbers, as approved by D-11, was passed.

Section 6 on reference materials, headed by S. S. Doner, Raybestos-Manhattan, Inc., reported that its assignment was completed, and the section was discharged with thanks.

Section 7 on description of types of styrene-butadiene rubbers and latices has also completed its work with the publication of D 1419-56T, Recommended Practice for Description of Types of Styrene-Butadiene Rubber (SBR) and Butadiene Rubber (BR), and D 1420-56T, Recommended Practice for Description of Types of Styrene-Butadiene Rubber (SBR) and Butadiene Rubber (SBR) and Butadiene Rubber (SBR) and Butadiene Rubber (BR) Latices, and was also discharged with thanks.

Compound recipes for reference testing for all new SBR numbers are to be submitted for assignment in D 15-55T.

Subcommittee 14—Abrasion Tests. R. F. Tener, NBS, chairman. Activities at the ISO/TC 45 meeting of September. 1957, in connection with abrasion and tear resistance were reported to the subcommittee by H. G. Bimmerman, E. I. du Pont de Nemours & Co., Inc.

The following scope for subcommittee 14 was approved: "The development of methods of test for abrasion, tearing and cutting resistance of rubber and

rubber-like materials.

A proposed revision of D 394-47, Method of Test for Abrasion Resistance of Rubber Compounds, and a proposed tentative standard for abrasion resistance of soles and heels were approved for letter-ballot in the subcommittee.

Subcommittee 15—Life Tests. G. C. Maassen, chairman. It was voted that D 1206-52T. Method of Test for Resistance to Aging of Vulcanized Rubber by Measurement of Creep, be kept tentative pending the results of work being done at the NBS.

D 1149-55T. Method of Test for Accelerated Ozone Cracking of Vulcanized Rubber, will also be kept tentative because of proposed changes in this method now being evaluated.

D 749-43T. Method of Calibrating a

Light Source Used for Accelerating the Deterioration of Rubber, and D 750-55T. Method of Test for Resistance of Light Aging of Rubber Compounds will also remain tentative until a satisfactory means for calibrating the light source evolves from the work presently being done.

A. G. Vieth, Goodrich, gave a report on the inter-laboratory ozone test program being done by task group 5 of

subcommittee 15.

It was voted that a committee comprised of members of subcommittees 5 and 15 of Committee D-11 and of Committee D-20 should be established to investigate and to develop ways and means of aging in a uniform manner polyvinyl chloride and other compositions containing substantial (high) amounts of plasticizer.

Subcommittee 17—Hardness, Set, and Creep. S. R. Doner, chairman. It was decided that the scope of subcommittee 17 should read as follows: "Formulation of methods of test for the hardness, compression set, and creep or stress relaxation characteristics of rubber and rubber-like materials."

It was voted that D 314-52T, Method of Test for Hardness of Rubber, be advanced from a tentative to a regular

standard.

Editorial corrections in D 1415-56T, Method of Test for International Standard Hardness of Natural and Synthetic Rubbers, are recommended as follows:

In the next to the last paragraph of the foreword, the value "1.37" should be "1.367," and "300 psi. "should be "331 psi." In the last paragraph, "which equals" should be "is equal to."

equals" should be "is equal to."

Under "Apparatus," section 2(a).
change "2.44 ±0.06 mm." to "2.38 or
2.50 ±0.01 mm." Balls 2.44 mm. in
diameter are not available, and the
method originally intended that 2.38or 2.50-mm. balls should be used. Under section 2(b), the first paragraph
should read as follows: "Load applicator for applying loads of 30 ±1g. and
564 ±2g. to a 2.38 mm. ball or 580
±2g. to a 2.50 mm. ball." Under section 2(d) change "500 and 600" to
"600 and 900."

Under "Procedure," section 5(b), change the last sentence to read, "Apply an additional load of 534 or 550 g. ±1g depending on the size of ball on the indentor and maintain it for 30 sec. (Note)."

Subcommittee 17 chairman will circulate a questionnaire in connection with the use of a molded as well as a cut compression set specimen in D 395-55. Method of Test for Compression Set of Vulcanized Rubber.

The subcommittee chairman will also circulate a questionnaire to determine if the durometer should be conditioned in a dessicator at low temperature before use in making hardness determinations at low temperatures.

Subcommittee 17 will register a negative vote with regard to ISO/TC 45

Draft Proposal for the Determination of Compression Set, CX(RUC) 9761, October, 1957, since the subcommittee does not agree that the surfaces of the test specimen should be lubricated with silicone oil.

Subcommittee 19—Properties of Rubber in Liquids. F. H. Fritz, Du Pont, chairman. It was agreed that D 471-57T. Method of Test for Change in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids; D 814-55, Method of Test for Permeability of Vulcanized Rubber or Synthetic Elastomers to Volatile Liquids; and D 1460-57T, Method of Test for Change in Length of an Elastomeric Vulcanizate Resulting from Immersion in a Liquid, should retain their present status.

H. G. Bimmerman reported on matters of interest to subcommittee 19 from the ISO/TC 45 meeting in Zurich. Switzerland. Decisions reached at the ISO/TC 45 meeting seemed to meet with the approval of the subcommittee, and ISO/TC 45 Document No. 238 will be circulated within the subcommittee when received.

A detailed report on the adequacy of D 471-57T at test temperatures of 300° F., from task group A. was requested for circulation within the subcommittee before a decision on releasing the task group from its assignment could be made.

F. D. Farnam Co. has requested a statement of policy from subcommittee 19 with regard to test fluids representative of new automotive fuels. The work along these lines by subsection 4H of SAE-ASTM Technical Committee A will be reviewed, and subcommittee interest determined at a later date.

Subcommittee 20—Adhesion Tests. H. Irvin, Marbon Chemical Division, Borg-Warner Corp., chairman. The following scope for subcommittee 20 will be letter-balloted in the subcommittee: "The development, preparation and standardization of test methods whereby accurate values of bond strength between elastomers and rigid materials can be determined."

The development of actual specifications from tests such as D 429-57T, Methods of Test for Adhesion of Vulcanized Rubber to Metal, will have to be resolved by Committee D-11 since it appears to involve participation with other groups.

J. H. Macey, Goodrich, and P. J. Larsen, Lord Mfg. Co., were asked to prepare written comments on the expansion of the current test methods for adhesion to include the possibility of determining environmental effects on bond strength.

Mr. Macey and W. A. Frye, Inland Mfg. Division, General Motors Corp., reported that no appreciable progress had been made in the use of non-destructive and dynamic test methods for adhesion.

R. D. Stiehler, reporting on ISO/TC 45 action on subcommittee 20's comments on ISO/TC 45 Draft Proposal No. 323 (equivalent to ASTM D 429-56T) said he believed that ISO/TC 45 had met the objections of the subcommittee to Part A, and that a soon-to-bepublished report would confirm this point. Part B is to be studied further by the ISO/TC 45 working group.

It was voted to advance D 429-56T to standard, and the subcommittee recommended such action to Committee D-11. The subcommittee also voted to retain D 413-39. Methods of Test for Adhesion of Vulcanized Rubber, in its present form as a standard method. Clarification of subcommittee 20 jurisdiction over D 413-39, however, is sought from Committee D-11 in view of the limitation in the proposed scope of subcommittee 20 to test methods for bonded assemblies in which one component is rigid.

In connection with a request from the chairman of subsection 4W of SAE-ASTM Tech. A for subcommittee 20 to comment on its activities in setting K values for rubber-to-metal bonds in D 735-57T, Specifications for Automotive Elastomer Compounds, Subcommittee 20 will ask for representation of subsection 4W in order to appraise this problem better.

Subcommittee 21-Rubber Cements. J. F. Anderson, Goodrich, chairman. Subcommittee 21 voted to advance D 1205-53T, Methods of Testing Brake Lining and Other Friction Materials, to standard: make no changes in the status of D 816-55, Methods of Testing Rubber Cements: and make no changes in the status of D 553-42. Methods of Test for Viscosity and Total Solids Content of Rubber Cements. An alternate to D 553-42, that is, D 927-55T, Method of Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer, was approved for incorporation in D-11 methods at the annual meeting in 1957. A footnote reference in D 553-42 to D 927-55T was suggested.

The task group on non-destructive test methods headed by C. Lupton. Bendix Products Division. Bendix Aviation Corp.. will prepare a proposed ASTM procedure based on the use of Magniflux Corp.'s "Sonizone" apparatus, for approval by the subcommittee by May 1, 1958, and for incorporation in D 1205-53T.

Further work on the disk shear test in D 1205-53T is being delayed pending changes in the equipment and method of preparation of the samples.

A task group was organized to investigate methods for determining rubber-to-cord adhesion.

It was suggested that subcommittee 8 might help subcommittee 20 in definitions for "adhesives" and "cements."

Subcommittee 22—Cellular Rubber. H. G. Bimmerman, chairman. A report on suggested changes in the indentation test for latex foam rubber in D 1055-56T, Specifications for Latex Foam Rubbers, by L. A. Wohler, Firestone, was discussed and accepted as recommended. The following changes will be submitted for letterballot in Committee D-11:

(1) Apparatus employs ball and socket joint except when testing flat stock when it is not required. (2) Speed of deflection shall be 0.5 to 25 inches per minute. (3) Thickness of specimen shall be no less than 34-inch. (4) Location of indentor foot is to be specified.

(5) A clarification of the preload and reading time is to be included.

These changes, when approved, will bring the ASTM and the Rubber Manufacturers Association methods for the indentation test for latex foam rubber into closer agreement.

In addition, the variation in test results obtained with different indentation machines was discussed, and R. H. Taylor, Scott Testers, E. C. Svendson, United States Rubber Co., and G. H. Barnes. Goodyear Tire & Rubber Co., will report on means of obtaining better correlation of such results at the next meeting. It was also pointed out that the indentation test is not reliable for thin samples of latex foam rubber.

The subcommittee chairman was requested to prepare a note on safety precautions to be taken when cellular rubber products are undergoing aging.

Some results on the aging of urethane foam rubber were presented, and the lack of correlation with natural aging was emphasized.

A. F. Sereque. Goodrich, presented a draft of test methods and specifications for closed-cell vinyl sponge, and The Society for the Plastics Industry. Inc., will undertake further revision of this material, based on comments which have been received.

It was voted to submit the latest revision of methods of test for vinyl foam of December 21, 1957, to letterballot in Committee D-11.

The latest revision of February 6, 1958, of the methods of test for urethane foam as prepared by the SPI will be further revised and submitted for letter-ballot in D-11.

Subcommittee 23—Hard Rubber. W. J. Dermody, Electric Storage Battery Co., chairman. D 530-55T, Methods of Testing Hard Rubber Products; D 639-52T, Methods of Testing Asphalt Composition Battery Containers; and D 1484-57T, Method of Test for Penetration of Hard Rubber by Type D Durometer, will remain on a tentative basis, according to the recommendations of the subcommittee.

The subcommittee chairman reported for J. R. Smyth, Electric Storage Battery, chairman of task group 1 on impact testing, and suggestions for changes in the next test program on impact testing will be forwarded to Mr. Smyth.

R. J. Wentland, The Richardson Co., reported that Committee D-20 on Plastics, subcommittee 1, section Q on indentation hardness, is reviewing D 676-55T. Method of Test for Indentation of Rubber by Means of a Durometer, and D 1484-57T, to determine the suitability of these methods for testing plastics. D 676-55T, however, is not under the jurisdiction of subcommittee 23 of D-11.

D 639-57T has been rewritten by the ASTM staff and as such in a part of the 1957 Supplement to the "Book of ASTM Standards, Part 6." A similar revision of D 530-55T would be desirable, but a considerable amount of standardization of methods, specimen condition, etc., is first required and will be started in advance of the June, 1958, meeting.

The scope of subcommittee 23 was reviewed and is now stated as follows: "Development, evaluation and standardization of test methods, classifications, specifications and recommended practices for rigid or near rigid vulcanizates of unsaturated elastomeric polymers, and including research investigations of the engineering properties of these materials. (Asphalt composition battery containers have, through usage, been considered also to be within the scope of this subcommittee.)"

Subcommittee 24—Coated Fabrics. K. L. Keene, U. S. Rubber, chairman. Subcommittee 24 voted to retain D 751-57T, Method of Testing Rubber-Coated Fabrics, as a tentative standard, and to retain D 815-47, Method of Test for the Hydrogen Permeability of Rubber-Coated Fabrics, as a full standard.

Changes in the section of D 751-57T pertaining to "bursting strength" were approved by a letter-ballot in the sub-committee and are now recommended for letter-ballot in Committee D-11.

Subcommittee 24 requested subcommittee 15 on Life Tests to report to it any progress in its work on the study of air circulation ovens used for aging tests.

Committee D-9 on Electrical Insulating Materials requested information from subcommittee 24 on a better means of testing silicone-coated fabrics for tensile strength.

Subcommittee 25—Low-Temperature Tests, R. S. Havenhill, St. Joseph Lead Co., chairman. Dr. Stiehler reported that possibly both low-temperature hardness and modulus could be obtained with the ISO (Wallace) dead-weight hardness instrument equipped with a liquid nitrogen chamber, and he will try to present a report on this matter at the next meeting.

The subcommittee voted to keep D 832-56T, Recommended Practice for Conditioning of Elastomeric Materials for Low-Temperature Testing, as a tentative standard.

In D 736-54T, Method of Test for Low-Temperature Brittleness of Rubber

and Rubber-Like Materials, in the note under "Apparatus, 2(a)" it was agreed to change the -65° F. to -67° F. in order to have this method conform to the recent change in D 735-57T.

In D 797-46, Method of Test for Young's Modulus in Flexure of Natural and Synthetic Elastomers at Normal and Subnormal Temperatures. it was agreed to change under "Procedure, 4(a)," lines 5 and 7, and "4(c)," line 4, the temperature from 70° F. to 73° F. Also, under "4(d)" change —70° F. to —67° F., and 70° F. to 73° F. These changes make D 797-46 conform to the temperatures recommended in D 1349-54T. Recommended Practice for Test Temperatures for Rubber and Rubber-Like Materials.

D 1053-54T, Method of Measuring Low-Temperature Stiffness of Rubber and Rubber-Like Materials by the Gehman Torsional Apparatus, will require a few editorial changes to make the method conform to the ISO/TC 45 method, and such changes were recommended. It was also recommended that some changes be made in the ISO method and that a "go-no go" provision be included.

Latest revisions in D 1329-54T, Method for Evaluating Low-Temperature Characteristics of Rubber and Rubber-Like Materials by a Temperature-Retraction Procedure, have been approved by D-11 and will be included in the 1958 D-11 handbook.

R. G. Dunlap, Smithers Laboratory, reported that good agreement by Rock Island Arsenal has been obtained in determining the speed of the Scott solenoid impact tester using the ball thrust method. He also reported that the procedure should be modified to start ball with solenoid rather than impact it, and that balls of different diameter should be tried.

The results of a survey of specimen size used with D 746-55T, Method of Test for Brittleness Temperature of Plastics and Elastomers by Impact. showed that 60% use the ¼-inch width specimen with parallel sides, and 40% use the narrow, 0.075- to 0.125-inch specimen. Since 77.6% of those using the narrow specimen favor the modified T50 specimen (0.10-inch width with ¼-inch tab on one end) it was agreed to use this-type specimen in the method in place of the regular T50 specimen and to include a line drawing of the die required.

The chairman of the subcommittee reported on the progress made on low-temperature test methods at the ISO/TC 45 meeting in Zurich, and stated that draft ISO proposals on methods similar to D 746-55T and D 1053-54T had been approved.

Subcommittee 26—Processibility. R. H. Taylor, chairman. The proposed scope of subcommittee 26 is as follows: "The development of methods of test for evaluating the processibility of unvulcanized rubber and rubber-like

materials and the curing characteristics of vulcanizable mixtures as determined from changes in viscosity."

T. Wolcznski, U. S. Rubber, head of the task group appointed to investigate various types of rotors for the Mooney viscometer, reported that the test program had been completed, but that there were indications that insufficient attention had been given to the effect of worn rotors on the test results. This effect will be investigated in more detail before a final report is submitted.

Ross Shearer, Goodrich, head of the task group appointed to study the desirability of combining D 927-55T. Method of Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer, and D 1077-55T, Method of Test for Curing Characteristics of Vulcanizable Rubber Mixtures during Heating by the Shearing Disk Viscometer, requested clarification of such points as thermocouple design, speed tolerances, sample preparation, the use of protective films, and whether the temperature-time curve should still be required. The advisability of combining the two methods is only supported by a slim majority, and to aid Mr. Shearer in his assignment George Decker, Monsanto Chemical Co., and E. B. Storey, Polymer Corp., Ltd., were added as new members of the task

J. S. Sweeley, Sun Oil Co., head of a task group assigned to study additional methods for evaluating processibility, recommended further work in connection with tests for determining roughness, shrinkage, plasticity, and extrusion characteristics of elastomers. Task group 4, headed by J. F. Kerscher, Goodyear, was appointed to develop and standardize extrusion processibility tests further, and task group 5, headed by F. J. Sackfield, American Synthetic Rubber Corp., was appointed to do the same work with shrinkage tests.

Subcommittee 27—Resilience Tests. W. A. Frye, chairman. D 945-55, Methods of Test for Mechanical Properties of Elastomeric Vulcanizates under Compressive or Shear Strain by the Mechanical Oscillograph, and D 1054-55, Method of Test for Impact Resilience and Penetration of Rubber by the Rebond Pendulum, were discussed. Tests for the resilience of urchane foam rubber and the standardization of forced vibration testing machines were also discussed.

The subcommittee chairman will circulate a questionnaire to determine the extent of present usage of various types of resilience tests.

Subcommittee 29—Compounding Ingredients. A. E. Juve, chairman. Seven negative votes in the latest Committee D-11 letter-ballot on "Tentative Methods for Testing Carbon Blacks in Rubber" were reported. Several of these negative votes were resolved by corre-

spondence, and the remainder, after discussion by the subcommittee, was considered not to be of sufficient importance or urgency to warrant further delay in adopting the method as a

tentative standard.

The NBS now has a 28,000-pound lot of standard natural rubber, actually two lots. Nos. 385 and 385A, which will be available for purchase in the near future. The rubber is Liberian crepe and certified by NBS to be of very uniform composition. A standard lot of mercaptobenzothiazole (MBT) is also available, and a standard lot of SBR 1500 has been obtained and is in the process of being certified.

A task group representing the interests of subcommittee 13, the carbon black interests in subcommittee 29, and the general interest group of subcommittee 29 will be appointed to consider recommending that D 15-57T, Sample Preparation for the Physical Testing of Rubber Products, be divided into two, three, or more ASTM designations.

ISO/TC 45 American Group

R. D. Stiehler, NBS, chairman of the American Group for ISO/TC 45, reported on the meeting of the ISO rubber committee held in Zurich, Switzerland, September 30 to October 5, 1957. Fourteen countries were represented by a total of 75 delegates, and four of these countries, that is, Hungary, Czechoslovakia, Poland, and the USSR were represented for the first time.

The following delegates, in addition to Dr. Stiehler, represented the United States at this meeting: G. H. Barnes, Goodyear; H. G. Bimmerman; S. R. Doner; B. S. Garvey, Jr.; R. S. Havenhill; Irving Kahn, Watertown Arsenal; J. F. Kerscher, Goodyear; H. Le Bovit; G. C. Maassen; J. C. Montermoso, Office of Quartermaster General.

A resolution was adopted by ISO/TC 45 paying tribute to the late Sidney A. Brazier, the first chairman of the ISO

rubber committee.

ISO/TC 61 on Plastics was represented by three delegates. Three delegates from ISO/TC 45, including Dr. Stiehler, were appointed to represent TC 45 on TC 61

The following actions were taken following the deliberations of the working groups which met during the meeting:

Eleven of the 16 ISO Draft proposals are now being considered by appropriate subcommittees of Committee D-11 of ASTM.

A reorganization of the working groups of ISO/TC 45 was authorized and will reduce the number to 10.

ISO/TC 45 has accepted the invitation of the United States to hold the eighth meeting of the committee in New York during the week of October 26, 1959, at which time specifications for rubber products will also be discussed. Italy has extended an invitation to hold the ninth meeting in Milan.

ISO/TC 45 has been one of the very active committees in the International Standards Organization, and six of the first 48 ISO recommendations originated ISO/TC 45. Subcommittees of ASTM Committee D-11 are urged to revise ASTM methods where necessary to make them conform with ISO recommendations insofar as possible.

SAE-ASTM Technical Committee on Automotive Rubber

H. Tangenberg, Goodrich, secretary of the SAE-ASTM Technical Committee on Automotive Rubber, reported on the activities of that group, but since a more detailed report by J. M. Ball, Midwest Rubber Reclaiming Co., is presented elsewhere in this issue Mr. Tangenberg's report will not be repeated

CCDA Annual Meeting On Synthetic Rubber

The annual meeting of the Commercial Chemical Development Association, to be held March 27 at the Statler Hotel, New York, N. Y ... will have as its theme, "The Commercial Impact of Synthetic Rubber."

As announced by Program Chairman F. Ruebensaal, Texas-U. S. Chemical Co., the morning session will start with a discussion of "European Developments in Rubber," by Alan Pickett, editor, The Rubber and Plastics Age, London, England. H. C. Bugbee, president of the Natural Rubber Bureau,

will talk about "Commercial Developments in Natural Rubber"; while Osgood Tracy, president, Enjay Co., Inc., will have as his subject, "Commercial Developments in Synthetic Rubber.

At the luncheon, John R. Blanford, counsel, House of Representatives, Committee on Armed Services, will describe "Congress and the Synthetic Rub-

ber Industry.

The afternoon session will include four separate panel discussions, each of which will be headed by leaders of the American rubber industry. panel titles and moderators are: "The Commercial Development of Purchased Government Facilities," W. P. Gee, president, Texas-U. S. Chemical; "Influence of Synthetic Rubber on Other Industries," C. J. Harrington, director of sales, elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc.: "Growth Forecasts for Rubber and the Impact of Other Materials," Ross R. Ormsby, president, the Rubber Manufacturers Association, Inc.; and "Growth Prospects for Rubber Raw Materials and Compounding Agents, William B. Plummer, consultant.

At the completion of the afternoon program, there will be a social hour and the annual banquet and presentation of the 1958 CCDA Award.

Ontario RG Hears Smith

The Ontario Rubber Group held its first meeting of the year on January 14 at the Pickfair Restaurant, Mimico. Ont. More than 120 members attended both the social gathering preceding the dinner, at which Cabot Carbon of Canada was host, and the dinner itself.

Carl Croakman, Columbian Carbon of Canada, Ltd., vice president of the group, was in the chair and introduced those present at the head table. Lloyd Lomas, St. Lawrence Chemical Co., Ltd., presented a silver plaque donated by his company to the immediate past chairman, W. Grushow, in appreciation of his very efficient work and service to the Ontario Rubber Group as executive member and chairman, on behalf of the entire membership.

W. R. Smith, Godfrey L. Cabot, Inc., was the guest speaker and discussed "The Behavior of Carbon Black in Rubber and Plastics," pointing out that in the past the use of carbon black as a reinforcing agent has been limited to rubber. Today, however, its use has been extended to a variety of polymers. both elastic and plastic. At some temperature range even normally solid plastics go through an elastic phase of physical structure. In these new systems the behavior of the various grades of carbon black can be anticipated quite accurately from properties previously evaluated in rubber. An understanding of this behavior may be based on certain fundamental structures common to all high polymers.

Working Group Small Tensile Specimen Rubber-to-Metal Bonding ompression Set Low-Temperature Tests

Terminology Classification of Vulcanized Rubber Aging Copper and Manganese

Unvulcanized Rubber

Electrically Conductive Rubber Tear Strength Resistance to Liquids Microhardness

Action Further work recommended Circulate Draft ISO proposal Prepare Draft ISO proposal Circulate Draft ISO proposals on brittleness and stiffness. Further work recommended

Further work recommended Circulate Draft ISO proposal Prepare Draft ISO proposal on ozone resistance Circulate Draft ISO proposals Circulate Draft ISO proposals on sampling, dirt, volatile matter, ash, rubber hydrocarbon, Mooney viscosity, and viscometer cure charac-

Mooney viscosity, and viscoineter cure characteristics of natural rubber.
Circulate Draft ISO proposal
Circulate Draft ISO proposal on Delft specimen
Further work recommended
Prepare Draft ISO proposal

SAE-ASTM Technical Committee Activities

Activities of the SAE-ASTM Technical Committee on Automotive Rubber1 have been expanded and intensified recently with the object of improving the workability and flexibility of the various specification tables covered by ASTM D 735-57T, Specifications for Automotive Elastomer Compounds. A report of the December 5-6, Detroit meeting of Technical Committe A. prepared by J. M. Ball, Midwest Rubber Reclaiming Co., includes information on this and other activities of this committee

Expanded ASTM D 735 Tables

Much interest exists in this new simplified format, and T. M. Loring, Chicago Rawhide Mfg. Co., chairman of the subsection IV-D in charge of this development, will for the next three months concern himself primarily with the problems of coordinating the AMS2 specifications into the new format. In this effort D. E. Manning, Pratt & Whitney Aircraft. AMS representative, has agreed to help. The larger significance of the new system, that is, its relation to military specifications. has, however, not yet been clarified.

Revision of D 735 Tables

Load deflection values for Suffix D are needed for certain classes of materials other than Type R compounds, specifically for silicone rubber compounds, Type T, Class TA in the D 735 tables. A sub-section was appointed to develop such values for Class TA compounds.

W. H. King, Acushnet Process Co., chairman of the subsection on compression set, reported on the progress his subsection has made in studying the problem of reduced time involved in compression set testing. Various rubber companies will supply 1/2-inchthick slabs cured from standard production stocks, in the 1,500-psi. tensile strength grades, in hardness from Shore A 40 through 80. Test specimens will be cut from these slabs in accordance with ASTM D 395 and tested under three conditions: 22 hours at 158° F.; 22 hours at 212° F.; and 70 hours at 212° F. The subsection will also include the relaxed compression set method developed some years ago by L. R. Sperberg.

Certain data on resilience are also needed, and S. R. Shuart, The Enjay Co., has agreed to send data on certain low-resilience compounds. After study of such data it will then be decided whether further work will be needed to continue the study.

Fluid Aging

B. H. Capen, Tyer Rubber Co., presented results of a survey on the composition of aromatic super-premium gasolines, and a proposed program for

evaluating the effect of aromatic-type fuels on rubber stocks. The subsection finds a very high variation in analysis of the many kinds of commercial premium gasolines with respect to aromatic content, olefin content, and saturates content. For example, the analysis of three representative fuels was found to be as follows:

	X	Y	Z
Olefins Aromatics	28.5% 18.4	12.0% 29.7	9.2% 47.6
Saturates	53.1	100	43.2

From the literature it was observed that the aromatics usually found in catalytic reformates are approximately:

Toluene Xylene Heavy aromatics	(C ₀ -C ₁₀)	22% 43 35
		100

In view of the fact that it is impossible to obtain a standard commercial super-gasoline, the subsection has decided to conduct a round-robin on four aromatic fuels of known composition, using four different compounds, two from Class SB and two from Class SC of D 735. These compounds will be tested before and after immersion for 70 hours at room temperature in the four fuels, for modulus, tensile strength, and elongation. Also, the volume change and durometer hardness are to be determined after drying to constant weight.

B. Vandermar, Acadia Synthetic Products Division, Western Felt Works. outlined a round-robin program for the study of the effect of SAE fuels and lubricants on various polymers.

Cellular Rubber

Test methods for vinvl and urethane foam have been drawn up, but have not yet been approved by all parties. The subsection under the chairmanship of C. S. Yoran, Brown Rubber Co., therefore regrets that publication of these methods in the 1958 SAE and ASTM handbooks will not be possible. This is a disappointment inasmuch as the subsection has been working on these methods for a long time (in the case of vinyl foam for 31/2 years). and the subsection feels that it is unfortunate that the methods cannot get into print promptly so that they can be more widely used.

Impact Testing

R. P. Schmuckal, Ford Motor Co., chairman of the subsection on impact testing, reported that it is the desire of this group to develop test equipment and procedure for small laboratory specimens instead of for full-scale ac-

¹ RUBBER WORLD, Oct., 1957, p. 97. ² Aeronautical Material Specifications, Society of Automotive Engineers, New York, N. Y.

tual production bumpers. The first step. therefore, is to consult with some equipment manufacturing company. Any constructive suggestions and offers of help will be greatly appreciated.

Tear Testing

H. Tangenberg, B. F. Goodrich Co.. chairman of this subsection, reported that his committee is in need of additional data on tear resistance of commercial compounds of various hardnesses and also, if possible, accompanying data on other properties including material cost. Various members of Section IV were requested to furnish such data.

Standardization of Ozone Test Boxes

M. M. Lowman, Goodyear Tire & Rubber Co., chairman of this subsection, reported that his committee is planning a round-robin test, samples for which were circulated in February. together with photographs and complete instructions for carrying out the test. The test will comprise the testing of two wax-free neoprene compounds. Cracking will be carried up to a rating of two under known ozone box conditions, and it is hoped that the data will be ready for publication in the next report.

Flexing

D. A. Sherman, United States Rubber Co., chairman of this subsection, reported preliminary flexing data obtained on four compounds by seven different laboratories. Two of the samples were of neoprene, both for the same use, and there was general agreement among the various laboratories that by the De Mattia bend test these two compounds had a shorter flexing life than the other two compounds which were of natural rubber, both representing engine mounting formulations. The various laboratories, however, did not line up the two natural rubber compounds in the same order. Additional results were obtained also by the De Mattia extension test and by the Goodrich flexometer test. The four compounds represented commercial stocks, of which a supply in uncured form was sent by the manufacturers to one laboratory for curing.

So far as the De Mattia bend test is concerned the following points must be resolved:

(1) Should pierced or unpierced

samples be used?

(2) Should the end point be kilocycles to 0.5-inch of cracking, or to complete failure?

(3) Should the data be analyzed by use of a log scale for a given number of cycles, or for a given length of crack?

With the De Mattia extension test, results from the two laboratories indicated some agreement even though

different speeds were used: namely, 60 cycles and 600 cycles per minute. With the Goodrich flexometer only two reports were available in which widely different conditions of test were used. Additional data from three more laboratories will be obtained using the same conditions of test.

It is hoped that this additional program will be completed in time for the next meeting so that a selection of uniform test methods can be made for future work.

Bond after Vulcanization

H. G. Winters, Cadillac Motor Division of General Motors Corp., chairman of this subsection, reported adhesion values of rubber cemented to steel. Four laboratories conducted these tests, using four cements and three rubber compounds varying in wax content. The base compound was SR 715. With a single exception adhesions were inversely proportional to the amount of wax in the compound. Future work will include different SBR compounds, and also an SR 715 compound of four additional rubbers, all with no wax. A single cement will be used for this continuing work.

Hose

C. P. Mullin, Gates Rubber Co.. chairman of this subsection, reported as follows:

Coolant hose. The Ordnance Department is considering release of ZZ-8-428, coolant system hose.

Fuel, oil line, and hydraulic hose. It has been agreed that some type of specification for Freon hose should be prepared.

Hydraulic brake hose. The use of materials other than cotton (such as rayon) in the manufacture of this type of hose has been reviewed several times, but the decision has been to remain with cotton reinforcement.

NSF R & D Conference

Plans for a conference on "Research and Development and Its Impact on the Economy," to be held in Washington in the spring, were announced by Alan T. Waterman, director of the National Science Foundation. Washington, D. C.

The conference will bring together key people from all sectors of the economy, private industry, government, universities, and research organizations concerned with the efforts of research and development on the individual firm, educational institutions, the defense effort, and the economy as a whole. This conference also will focus attention on the economic importance of the nation's research and development activities, now estimated to account for annual expenditures of about \$10 billion. The effect of such expenditures

in stabilizing and promoting the growth of the economy, especially in periods of recession, will be one of the principal topics to be discussed by the conferees. Leading authorities in the research and development field will participate in the discussion. Proceedings of the conference will be published by the Foundation.

The conference is being planned by the Foundation as part of its program to study the volume of research and development in all sectors of the economy, in terms of both expenditures and manpower engaged in the work, and of the impact of this important activity on the nation's economic well-being. Support of this conference is in accord with the Act establishing the National Science Foundation, which specifically charges it with responsibility for appraising the impact of research upon industrial development and upon the general welfare.

Fort Wayne Panel on Plastics Extrusion

The third meeting of the 1957-58 season of the Fort Wayne Rubber & Plastics Group was held at the Van Orman Hotel, Fort Wayne, Ind., February 13. Dinner and a panel discussion on "Factors Affecting Quality in Plastics Extrusion" were attended by 200 guests and members.

The panel discussion was moderated by P. Wilton, development department, Bakelite Co., Bound Brook, N. J., and included talks by B. H. Maddock, B. Zurkoff, and H. J. Nalepa, all of the same department.

The program began with a brief review of the theory involved, progressed to the important findings of the experimental activity, and continued with illustrations as to how the theory can be applied to the extrusion of various products from polyethylene, vinyls, and impact polystyrene. The presentation concluded with a review of an important development in extrusion method -the control of pressure in an extruder by means of a valve. By this method extrusion rates can be increased so that an extruder can be made to operate at its maximum capacity in producing a high-quality product. The introduction of this principle, called "Controlled-Pressure Extrusion," has been accorded an enthusiastic reception by the plastics industry, it was said.

Mr. Maddock, in discussing the theory of mixing, reviewed the fundamental principles involved in an extrusion process wherein a valve was used between the extruder screw and the die for control of extrusion pressure. He stated that while the conventional plastic extruder has not generally been considered a good mixing device, it can be shown that the mixing efficiency of most machines can be im-

proved by proper control of the presure variable, and that by this means maximum output of acceptable quality product can be obtained.

He went on to consider factors as product homogeneity, effects of screw speed and screw temperature, mixing efficiency, and control of mixing efficiency. Tables, plots and formulae were presented to explain further the mechanisms under consideration. He gave a detailed description of the degree of mixing accomplished in the screw channel and several aspects of product quality.

Mr. Zurkoff discussed how the fundamentals of extrusion may be applied to product extrusion in obtaining maximum extruded performance. The products chosen for the initial study of the application of "Controlled-Pressure Extrusion" were polyethylene and impact styrene sheet. For the purpose of observing dispersion, a mix of natural and red styrene was fed into the extruder and extruded in sheet form. A number of different screws, both deep and shallow channel type, were investigated to determine which had the best characteristics for sheet extrusion. Tables illustrated the output as affected by pressure, showed that the shallow channel screw had the greater sheet output rates, and gave the screw characteristic curves for a shallow channel screw, four methods of obtaining pressure, and a list of advantages which can be gained by "Controlled-Pressure Extrusion."

Mr. Nalepa dealt with the investigation of the controlled-extrusion of vinyl dry-blends, discovering, in general, that the effect of pressure on extrusion performance is similar to the experience with polyethylene and impact styrene. Increased pressures were found to improve quality so that quality defects such as fish-eyes and rugosity, defects commonly associated with the extrusion of vinyl dry-blends, were satisfactorily eliminated. In this investigation a streamlined valve was used to prevent hang up and decomposition of the heatsensitive resin. As in sheet extrusion, the valving mechanism was located between the screw and the die; but in the case of wire coating, a valve was built into an existing cross-head.

In conclusion, it was stated that one valve design can be made satisfactorily for all the thermoplastic materials if the special characteristics of the most critical of these are taken into consideration. One such consideration is the heat sensitivity of vinyls as this factor demands that the design of the valve precludes the possibility of the dead spots which result in hang-up and subsequent decomposition. A survey revealed that suitable valves were not available commercially and for extensive studies had to be designed. Various Bakelite designs were illustrated schematically.

WRG Tenth Anniversary Meeting Highlighted by Papers By Humphreys, Dinsmore, Astin

Despite some of the worst winter weather of the year and in fact for several years, the Decennial Aniversary Meeting of the Washington Rubber Group at the National Press Club, Washington, D. C., February 18, was a well-attended, very successful affair. The afternoon technical session heard papers by Allen V. Astin, director of the National Bureau of Standards, and R. P. Dinsmore, vice president of Goodyear Tire & Rubber Co. Douglas K. Bonn. United States Rubber Co., president of the Group. presided at this session, which included a question-and-answer period following the presentation of the papers.

The reception at 6:30 in the evening was followed by a banquet at which H. E. Humphreys, Jr., chairman of the board, U. S. Rubber, was the speaker. W. J. Sears, vice president. The Rubber Manufacturers Association, Inc., was toastmaster at the banquet and very ably handled this part of the anniversary celebration. which included presentation of special awards and the introduction of distinguished guests at the head table and

Mr. Humphreys.

Mr. Sears, himself a past president of the WRG and a member of the decennial committee headed by T. A. Werkenthin, U. S. Navy, Bureau of Ships, first introduced all of the past presidents of the Group present at the banquet. He then presented honorary life memberships and citations for their contributions to the WRG to E. G. Holt, recently retired assistant director of the Chemical & Rubber Bureau. Business & Defense Services Administration, United States Department of Commerce, who after more than 40 years of government service is known in Washington as "Mr. Rubber"; and to Mr. Werkenthin, first president of the Group and one of those responsible for its formation in 1948.

Mr. Sears read a telegram from R. F. Dunbrook. Firestone Tire & Rubber Co., and 1958 chairman of the Division of Rubber Chemistry, American Chemical Society, expressing his regrets at not being able to attend the WRG celebration and paying tribute to the Group's activities over the

past 10 years.

Distinguished guests at the head table, besides the speakers during the afternoon and evening. Holt, Werkenthin, and Bonn, and R. D. Stiehler. NBS, 1958 Group vice chairman, included J. R. Blanford, counsel for the House Armed Services Committee; Paul D. Foote, Assistant Secretary of Defense; Thomas C. Mann, Assistant Secretary for Economic Affairs, U. S. Department of State; Rear Admiral A. G. Mumma, Chief, Bureau of Ships, U. S. Navy; and John S. Patterson, Deputy Director, Office of Defense Mobilization.

"Rubber's Role"

Mr. Humphreys in his talk entitled, "Rubber's Role in Our Nation's Strength," first mentioned that ten years ago, when the WRG was formed, was a time of readjustment from an emergency period, and there were still government controls over the use of rubber, primarily because there just wasn't enough of it to go around. Today our nation and along with it the rubber industry is in many ways in a new kind of emergency, that of a cold war which calls for maintaining a vigorous civilian effort while we keep our military defenses strong, he added.

The U.S. Rubber Chairman said he saw six principal ways in which the rubber industry could and to a large extent already does contribute to the nation's strength both on the defense and civilian fronts:

First, by maintaining an adequate and protected raw material supply. Second, by responding to the forces

of all-out competition.

Third, by maintaining a skilled work force in factory and laboratory. Fourth by maintaining financial strength.

Fifth, by continuing to expand research.

Sixth. by providing new and better products.

In connection with raw material supply, Mr. Humphreys stated our warsynthetic rubber plants today stand as one of the rubber industry's greatest assets in its ability to contribute to national strength. With our present large capacity to produce general-purpose and other types of synthetic rubbers and with the new isoprene type of synthetic rubber, we could get along nicely with no natural rubber if we ever needed to. he added.

"Thus, I am pleased to learn of the three-year rubber stockpile base recommended by the Special Stockpile Advisory Committee of the Office of Defense Mobilization. Certainly this is more realistic than the five-year supply we have been maintaining and if an even smaller stockpile were considered enough by our military people, I'd certainly be in favor of it. Mr. Humphreys declared.

The long-term future of natural rubber depends on a policy of producing lots of rubber at a low price, and natural rubber can be raised under good conditions at prices as low as 9¢ or 10¢ a pound, it was pointed out. If lower and more stable prices for natural rubber are delayed too long, the rubber producing countries will find that they have been holding an umbrella over the development of synthetic which can replace it entirely.

The rubber industry helps to build national strength by competition between the companies that are a part of it, and this competition is just as great among all 1,300 or more companies in the industry as it is among the largest companies. The increase in value of the present-day automobile tire and at a price no greater than the increase in the cost of living during the past 20 years was cited as evidence of the better values the public and government have received owing to competi-

Besides offering the nation a skilled body of 270,000 workers in our own industry, the rubber companies are helping build a skilled work force and an intelligent citizenry for the entire nation by keeping in the forefront in the support of higher education. Employes of the rubber industry are among the best paid in the world. Mr. Humphreys said he was in favor of high pay for rubber industry workers. but he often wondered if rubber industry management wasn't guilty of permitting too wide a gap to develop between this ideal and the productivity on which it must depend.

The fourth way the rubber industry can contribute to the nation's strength is to maintain its financial strength by providing for an adequate return on invested capital, and here the industry has not done its best job, the speaker said. In 1956 the rubber industry stood in fifteenth place on the list of 23 major industries in order of their return on invested capital. Managements of rubber companies were urged to give the public the facts behind the profit-squeeze situation in order to help the customer understand why price increases are sometimes necessary and the employe to see that wages cannot keep on going up unless productivity goes up at the same rate.

In discussing the ways in which research and development in the rubber industry contributed to the nation's strength. Mr. Humphreys emphasized the increasing attention the industry is devoting to this activity, with special reference to the role of atomic energy

research.

New and better products, the last item on the list of rubber industry contributions, is headed by tires, and as still better tires are developed our greatest and most essential rubber stockpile will become more effective, it was said. A few of the newer rubber products made available by the rubber industry for national defense include

military fuel containers that roll over rough terrain; special clothing for missile work, work under water, and for high-altitude plane pilots; improved hose and expansion joints for submarines; solid jet fuels and fuel containers for rocket motors, missiles, and missile components.

It was also pointed out that the rubber industry is active in plastics, chemicals, synthetic fibers, electronics, ordnance, propulsion, and atomic energy, all of which puts the rubber industry squarely in the foreground to be called on by government in the event of any emergency.

Everything considered, Mr. Humphreys said, the rubber industry is in most respects well prepared to help guard the nation's strength, both defense and civilian, today and in the future.

Decennial Booklet

At the conclusion of the anniversary program, copies of a special decennial anniversary booklet containing history, officers, membership, and an account of postwar Washington rubber developments were distributed, "The History of the Washington Rubber Group" was written by Norman Bekkedahl, NBS, and a past president of the Group, and the article "Postwar Washington Rubber Developments," by Mr. Holt.

The Technical Session

The afternoon technical session consisted of a paper by Allen V. Astin. NBS director, entitled, "Measurement. Rubber Research and Technological Competition"; and one by Raymond P. Dinsmore, Goodyear vice president, on the subject, "Tires for Today's Cars." Both of these papers contained many points of very great interest to technologists in today's rubber and associated industries.

Dr. Astin began by referring to the evolution of unprecedented interest in the status of our nation's technological strength since October 4, 1957, the date of the launching of Russia's first earth satellite. His paper was devoted to one of the several long-range activities that is basic to dynamic and progressive technological competence, that is, the area of precise and reliable physical measurement. He first outlined the important relation of physical measurement to technological progress, then discussed the responsibilities of the NBS in advancing the science of accurate measurement, gave examples of how rubber technology has advanced as it has become possible to measure and control the physical and chemical properties of rubber more precisely, and finally related his subject to the technological challenge of the Soviet Union. with emphasis on its efforts to strengthen its competitive position through extensive attention to its competence in the field of exact measure-



H. E. Humphreys, Jr., left, WRG decennial anniversary dinner speaker, and W. J. Sears, toastmaster

Throughout the development of our technological industry, the speaker said, efficiency has increased as the physical characteristics of interchangeable parts have been controlled with greater reliability and precision. In the fabrication of today's products it is necessary to control physical characteristics by electrical, electronic, light and color, atomic and nuclear radiation, and chemical measurement techniques. The tremendous growth of a highly specialized instrumentation industry is perhaps the greatest evidence of the importance of measurement to modern technology.

The responsibility to fix the standards for weights and measures which has been assigned by Congress to the NBS is today more complex than it was in the days when the only important measurements dealt with weight. length, and volume. Measurement standards must now be available in all areas of science and technology where physical measurement is important. Scientific and industrial laboratories should be able to look to and properly expect from a national standards laboratory advice and assistance on the effective utilization of advanced techniques in physical measurement and to make accurate and reliable determinations on the properties of basic materials. The provision of such data is one of the statutory functions of the NBS, and the acquisition and the dissemination of such data aid materially the work of scientists in other laboratories and of engineers in their design problems.

Early work at NBS on the chemical and physical tests for rubber products was first published in 1912 as Circular C38. At about the same time Committee D-11 on Rubber of the American Society for Testing Materials was organized, and many of the tests from Circular C38 were included in the first standards of Committee D-11. Despite the great strides made since that time, present measurement techniques have numerous deficiencies in comparison with current needs. Toward the end of developing superior methods of measurement and at the same time acquiring more meaningful data on basic properties, the program at NBS on

rubber and related organic materials has been gradually shifted over recent years to a more fundamental approach as contrasted with the semi-empirical approach which has categorized much of the earlier work. The present objective of NBS is to provide an explanation of some of the mechanical properties of rubber in terms of molecular structure.

In a related area the Bureau is also trying to give increased attention to the promotion of reliable measurement and quality control techniques through the use of standard samples, and at present. 14 standard compounding ingredients and three standard rubbers are supplied to the rubber industry for improving accuracy of measurement.

'Measurement Engineering." the official organ of the Committee on Standards, Measures, and Measurement Apparatus of the Council of Ministers of the USSR, points out that the major objective of the sixth Five-Year Plan. which began in 1956, is to increase means of production by approximately 70% and output of consumer goods by approximately 60%. Substantial increases in the output of basic materials and an increase in the output of its machine tool industry by approximately 80% are also included in the program. These increases in productivity call for extensive expansion of the instrumentation industry and for the broad adoption throughout industry of automatic control and regulation of technological processes.

It may be inferred that Russian activities in the field of standards and precision measurement are operated from a higher government level than any other industrial activity in the USSR; the investment in these areas is extremely large and is directed toward increasing automation in large segments of Russian industry; there appears to be a clear tendency to lean heavily on theoretical analysis of technological problems, and there is a program to inculcate cooperative technological efforts among relevant branches of the economy, including education.

Dr. Astin said in conclusion that the challenge to our standard of living and our democratic way of life is of such major importance that he believes it should be brought with increasing force to the consciousness of our whole society, and that the economic and technological aspects of this challenge warrant the full consideration of American industry and business.

Dr. Dinsmore, because of illness could not present his paper on "Tires for Today's Cars," and it was therefore given by J. D. D'lanni, assistant to the vice president for research and development at Goodyear.

The drastic changes in the character of our public highways and the performance of the automobile, particularly during the past five years, have required a rapid and continuous evolution of the tire to keep pace, the Goodyear vice president explained. A tire

which cannot run for an hour under summer conditions at sustained high speeds is not an acceptable piece of equipment for a modern automobile, he added.

Tires in use today are able to withstand the effects of fast starting and stopping, the negotiation of curves at high speeds, and the bruising and shearing effects of fast speeds over rough roads. Nonetheless, the heavier, more powerful automobiles operating on today's high-speed highways have created new problems for the rubber industry, despite the tremendous advancements achieved in tire design and performance.

Excessive tread wear is one problem, and it was reported that changing from 50 to 80 miles per hour increased the rate of wear by 57%. Speed has other effects, and it was also reported that groove cracking, which developed in 7,000 miles at 60 mph., was evident in 100 miles at 100 mph.

Other data presented showed the effect of heat on tensile strength and resilience of natural, styrene-butadiene (SBR), and butyl (IIR) rubbers, and on cord adhesion in a natural rubber compound. The instantaneous effect of elevated temperatures influences tread wear, the bond strength of rubber to the cord plies, the adhesion of the tread to carcass, the shear resistance between plies and other vital tire features.

With regard to cord materials it was emphasized that the cord which gives the tire its bruise resistance is weakened by heat unless it is made of an organic material like steel. For passenger-car tires, steel cords produce tires too rigid to absorb small impacts by envelopment so that tires of this material give too rough a ride in present-day American passenger cars.

Cotton is pretty much out of the running as a tire cord material because rayon has excelled in performance and allowed the manufacture of a tire at least equal cost. Nylon has shown many superiorities, particularly with respect to high-temperature performance and resistance to impact bruising at all temperatures. Nevertheless nylon's plastic characteristics and its tendency to shrink at the high temperatures of vulcanization have created some service problems which have not been completely solved, although Dr. Dinsmore said he believes they are well on the way to solution. The outstanding obstacle to the use of nylon as a rather complete replacement for rayon is its cost, because, although it provides adequate carcass strength when nylon is substituted for rayon on an equal cost basis, at the tensions imposed on the cords, there is too much tire growth, cracking, and tendency for cord slippage, he added.

Tread caps of polyurethane rubber, which would permit the use of thinner treads, may be a possibility in the near future and would improve tread wear materially. For a given compound, made

from any tire elastomer, tread wear depends to a considerable degree on the dispersion of the reinforcing carbon blacks, and although the possibilities of improvement here are not so great as those from polyurethane, the application is much simpler.

Another aspect of tire performance, which does not have much to do with tire life or safety, but which primarily affects the comfort of the passenger is tire vibration transmitted to various parts of the car. Data were presented to show that small irregularities in a tire will produce vibrations at certain frequencies which with certain cars will produce sensations of "thump" or "roughness." Although tires are often the source of vibration initiation, different cars respond differently.

Many attempts have been made to introduce tire construction features which would scramble the vibrations so that they would not produce the beats which are so objectionable. To date the best efforts which can be obtained by the tire manufacturer are from rigid elimination of large irregularities. The car manufacturer has done much to reduce vibration in recent models and will probably do more in the future as more is learned about what vibrations are most objectionable to the car driver and how these vibrations are transmitted.

Northeast Section Meets

The February 18 meeting of the Elastomer & Plastics Group, Northeastern Section, ACS, held at Science Park, Charles River Dam, Boston, Mass., was attended by 80 members and guests to hear George L. Brown, Rohm & Haas Co., substituting for R. J. Meyers, same company, and speaking on "Recent Developments in Acrylate Polymer Applications." The usual cocktail hour and catered dinner preceding the meeting were well attended.

The speaker was introduced by M. Taitel, UBS Chemicals, chairman of the Group. Using colored slides, Dr. Brown first outlined and then illustrated his talk on acrylate polymer developments.

He described seven basic factors common to acrylates and methacrylates that make them desirable as polymers, ranging from color quality and stability, chemical resistance and property-functional, ester-group tailoring possibilities, to their ease of polymerization and high degree of conversion. The cause of methacrylate polymer differences from acrylate polymers was shown to be due to steric hindrance and chain length differences.

The application of solid, solution and emulsion forms of the polymers was considered; their rapidly expanding applications in advertising signs and auto lenses, as exchange resins, shoe heels, medallions, automobile finishes and luminescent paints, as latex thickeners, nylon sizes, paper saturants and wallpaper finishes, and as floor waxes and ceramic glazes were illustrated with numerous slides.

Dr. Brown discussed the use of free monomers in the synthesis of polymers and polymerizable plasticizers, with the specialized end-use of embedment of machine parts and biological specimens also being considered.

Questions on the scratch-resistance, light diffusion, and flocculation properties of acrylates were considered at the close of the meeting.

Detroit RG Lab Course

In the spring semester of 1958, Wayne State University will initiate a new laboratory course in rubber technology which has been prepared in cooperation with the Detroit Rubber & Plastics Group. Supported by contributions from industry, the new lab is well equipped to provide students with a thorough grounding in the fundamentals of rubber processing and testing techniques.

Applications for enrollment exceeded the limit for the number of students which has been set at 12. The relatively small class was decided upon in order that all students would have ample opportunity to work personally with the various types of laboratory equipment. Enrollment preference is being given to applicants who have taken the lecture courses in rubber technology which have been offered at Wayne for several years.

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The course will consist of 16 weekly meetings of three hours each, which will include ½-hour of discussion and 2½ hours of lab work. The scope of the course covers both general-purpose elastomers and specialty elastomers, including neoprene, nitrile, butyl, and Hypalon synthetic rubbers. The series of experiments on general-purpose elastomers will cover basic processing along with investigation of accelerator systems, antioxidants, and carbon black reinforcements.

Ralph Huizinga, United States Rubber Co., has been selected as instructor for this course. In 16 years with U. S. Rubber he has had a wide variety of experience in the compounding field and is currently engaged in tire development work.

In addition to the new laboratory course, the spring semester at Wayne will again see the advanced lecture course offered. This course has had a continuing high level of interest and normally is taken by 20 to 30 students. Continuing as instructor for the course is C. Albers, assistant technical superintendent, Baldwin Rubber Co., Pontiac, Mich.

ARG Discusses Statistical Quality Control

A "Symposium on Statistical Quality Control" was the main event of the winter meeting of the Akron Rubber Group, Inc., held January 24, at the Sheraton-Mayflower Hotel, Akron, O. The Group's evening program featured Spencer Irwin, associate editor of foreign affairs, Cleveland Plain Dealer, as after-dinner speaker. Mr. Irwin's topic was, "America's Place in World Affairs." Meeting attendance was between 700 and 800.

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Moderator for the afternoon panel discussion was E. M. Bader, B. F. Goodrich Aviation Products Co. Panel members consisted of J. N. Berrettoni, Lamson & Sessions Co.; Donald L. Dewing, General Tire & Rubber Co.; L. A. Bedford, Goodyear Tire & Rubber Co.; and F. J. Newton, Ford Motor Co.

"Organizing for Quality Control"

Dr. Berrettoni emphasized in his talk that there are three distinct, fundamental steps toward setting up a working quality-control program.

The first step is securing from high level management recognition of the need of quality control as a separate company function and then assigning management authority to the quality-control function. Dr. Berrettoni suggests a position and title of "vice president of quality."

The second step in this crusade for quality control is to determine the different fields to be covered by statistical quality control. These are generally, the speaker stated, engineering; tools and machines; purchasing; production; gages and inspection; and sales. The speaker spelled out in considerable detail the inter-relation between these plant functions and statistical quality control.

A novel idea, but a good one, was his suggestion that the sales group and the quality-control group work together in analyzing and evaluating the customer's quality requirements in terms of "Acceptable Quality Level," his sampling plans, and his inspection methods. Another valuable suggestion was that customer complaints should be handled jointly by the sales and quality-control groups.

The third important step toward organizing for quality, said Dr. Berrettoni, was to hire competent help. In this respect, he pointed out that although a chemist or engineer could efficiently function as quality-control manager, he should provide himself with the services of a trained statistician.

After having established a qualitycontrol department, the temptation to think that quality is the sole responsibility of the quality-control department must be avoided; other departments must share that responsibility.

"Statistical Quality Control as Applied to Rubber Products"

"A thorough quality-control program must," according to Mr. Dewing, "start with the receipt of an order in the plant, continue through design, production, inspection, and shipping and end only with the satisfactory consumption or use of the product by the customer. The scope of the program is such that it becomes readily apparent that quality control is not the private domain of any one department or person, but is everybody's business."

The function of the modern quality-control department, said Mr. Dewing, is to coordinate and assist the quality efforts of the various operating groups and divisions.

Mr. Dewing defines statistical quality control to be simply the application of statistical techniques to the quality-control program.

Statistical techniques, the speaker stated, may be divided into three general categories—data processing, data analysis, and the design of experiments.

Data processing is simply the collection and summarizing of quality data.

Data analysis or data evaluation "consists of using existing data to draw conclusions about the quality of a product or process. In statistical terms," this speaker explained, "this is called statistical inference. The principal value of statistical inference lies in the fact that experimental error is considered, and the risk of making false conclusions can be reduced to any specified value desired."

The third category, design and analysis of experiments, involves the application of combinatorial analysis and various statistical and mathematical techniques to plan and execute experimental investigations.

"The value of statistically designed experiments," Mr. Dewing pointed out, "lies in the fact that all of the important variables which might cause the product or process problem are considered simultaneously, thus minimizing the amount of experimental effort required. In addition to determining the effect of each variable, the effect of various combinations of the variables can be determined. The best technical knowledge available is used to determine the variable to be studied. If this technical judgment is correct, the source or sources of the problem may be quickly isolated, and the variables having little or no effect can be discarded. If the technical judgment is wrong, and the most important variables are not selected, this will be pointed out by the first experiment.

ied until the problem is solved."

Although these statistical techniques are very powerful devices in obtaining and maintaining high product quality. Mr. Dewing emphasized that they

and additional variables may be stud-

should be applied only by persons with competent statistical training.

As places for application of statistical methods, he suggested that process capabilities should be determined before items are placed in production; and that statistically designed experiments could be used to establish and evaluate test programs, establish realistic design tolerances, determine the effect of raw material properties on process and product requirements, and optimize processing conditions.

Mr. Dewing stated that "the rubber industry is a fertile field for the use of statistical methods in quality control because of the large number of raw materials, process and product variables and also the large amount of unknowns"

"Statistical Quality Control in Chemical Processes"

Mr. Bedford introduced his topic by noting briefly some of the more important concepts of modern quality control. These concepts include: "the stressing of defect prevention rather than sorting good lots from bad ones; a scientific approach to quality with the use of statistical methods; the idea of 'staff' assistance to provide the time and skills to collect and analyze data"; and, finally, "an organizational set-up to coordinate quality efforts and programs."

From among the three areas of control (raw materials, in-process, finished product) in the manufacturing of chemicals that are amenable to statistical quality-control methods, Mr. Bedford directed his attention to process control. Here the primary problem is to know when the process is in "statistical" control; when the observed variation is due to chance alone, and when it is due to assignable causes.

when it is due to assignable causes.

Chemical plants have by tradition been "record keepers" rather than "data analyzers." Mr. Bedford has introduced statistical quality control into these groups by simply keeping the records on a statistical quality-control chart.

"A combination of Shewhart's 'average' and 'range' control charts," Mr. Bedford stated, "provides the most sensitive means of maintaining control."

As long as the plotted points remain within the control limits (calculated statistically and not based on specification limits), the process is presumed to be in control.

"Points outside these limits signal that an abnormal condition, an assignable cause, has entered the process. An investigation is in order to correct the cause, or loss of quality in the finished product will result. By the use of control charts trouble is spotted immediately. It is important to take action when the process is out of control, but it is equally important not



Moderator and panel members at Akron Rubber Group Symposium on Statistical Quality Control

to make adjustments when the process is in control."

It is not unusual, according to Mr. Bedford, for the use of quality-control charts "to improve the quality uniformity of products by 50% or more."

The final and necessary ingredient for better control, this speaker observed, is "action." Someone must take action on the inferences provided by control charts and other statistical devices. That "someone," Mr. Bedford suggested, should be "a plant team or committee consisting of the production foreman, quality control engineer, and a technical representative."

"Quality Control Applied to Consumer Requirements"

Mr. Newton discussed the control of quality of incoming materials and parts from the viewpoint of a consumer, in this case the Ford Motor Co.

When a new design or material is released by Ford's engineering department for production use, steps are immediately taken to assure that the various suppliers involved are capable of producing the part or material. This is accomplished by Ford's initial sample program.

This program. Mr. Newton said. "calls for the submission by the supplier of parts or materials of production tooling without .any handwork." These parts (from now on we will use the words parts and materials interchangeably) are subjected to layout, laboratory and functional testing to determine if they conform to blueprint specifications. If these samples are approved, the supplier is authorized to make one production shipment. Samples from this shipment go through the same testing procedure as the initial samples. After one production shipment is approved, the succeeding shipments are considered "routine shipments.

A quality engineer now makes a

complete analysis of the part blueprint to determine what dimensions or characteristics should be checked for rapid assessment of the acceptable quality of the part. From this study, Mr. Newton said, a detailed inspection operation sheet is prepared. "Routine shipments" are then inspected in accordance with these sheets. Also on the basis of the quality engineer's analysis, sampling frequencies are determined for routine shipment.

"The sample size is determined by the shipment size, in accordance with an acceptance sampling table derived from joint Army-Navy Standard 105."

A double-sampling plan, Mr. Newton stated, is used.

"If a shipment is rejected for any reason, the next shipment is inspected regardless of the frequencies established."

Both the purchasing department and the supplier are notified of the rejected shipment.

If the rejected shipment is needed in production, the material is sorted, and the salvable portion repaired. The cost of sorting and repairing is charged to the supplier. If the shipment is not needed in production, it is either scrapped locally or returned to the supplier as he directs.

Records are maintained on each part and each supplier. These records are used to determine the suppliers' performance record.

According to Mr. Newton, "suppliers which show a consistently poor quality performance are warned that unless corrective action is taken, they may not be considered in the placement of new business."

Parts having a constant and continuing poor quality performance regardless of supplier "are examined to determine whether or not a change should be made in order to make the part more easily manufactured on a commercial basis, or whether the tooling is adequate to produce quality merchandise."

Philadelphia Group Has Textiles-Rubber Panel

The Philadelphia Rubber Group meeting held at the Poor Richard Club. Philadelphia, Pa., January 24, featured a panel discussion on "The Use of Textiles in the Rubber Industry," and was attended by 170 members and guests. Group Chairman R. A. Garrett, Armstrong Cork Co., presided. It was announced that the Group

It was announced that the Group had 278 paid members, representing about one-half of its mailing list, and interested persons were urged to join the PRG in the near future in order to be included in a directory of members to be published shortly.

James M. Jones, Goodyear Tire & Rubber Co., has been appointed chairman of a newly created membership committee. Mr. Jones handled the drawing for the cash draw prizes which were all won by representatives of Carlisle Tire & Rubber Co.

The panel on textiles was composed of the following speakers: E. L. Borg, Naugatuck Chemical Division. United States Rubber Co.; D. H. Heckert, E. I. du Pont de Nemours & Co., Lac.; F. J. Kovac. Goodyear; C. H. Schroeder, The B. F. Goodrich Co.; and H. R. Schwarz. Wellington Sears Co. B. S. Garvey, Jr., Pennsalt Chemicals Corp., was the panel moderator, and a question-and-answer period followed the speakers' talks.

The after-dinner speaker was G. M. Koch, Dienelt & Eisenhardt, Inc., who gave a very interesting and humorous talk on the subject of "Where Are We Coince".

More complete details of the panel discussion will be presented in our April issue.

Boston RG Ski Outing

The annual Boston Rubber Group ski outing, held February 7-9 at the Bartlett Hotel, Bartlett, N. H., attracted 85 members and guests to the best skiing conditions yet experienced by the Group in its 10 years of outings.

Organized by James J. Breen, Barrett & Breen Co., secretary of the Boston Rubber Group, the crowd taxed the entire facilities of the hotel and of an adjacent annex, but all were accommodated. With excellent ski conditions, the active members and their sons visited popular Cranmore and Black mountains, and the new Wildcat-Polecat trail development where a 2½-mile intermediate-to-expert trail was recently opened.

One case of wrenched knee—John Potter, Apex Tire Co.—was the only casualty reported. Card games and general relaxing made the evenings enjoyable. The suppliers present acted as hosts for preprandial refreshment.

SRG Panel on Adhesion-II

Adhesives Applications in the Shoe, Flooring, and Automotive Industries

Lee L. Blyler
Howe & French, Inc.,
Weymouth, Mass.

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BEFORE getting into a discussion of specific adhesives for specific enduses, definitions and adhesion theory will be reviewed briefly.

What is an adhesive? Literally, it is a substance capable of holding materials together by surface attachment. The form of adhesive attachment obtained is generally recognized as being of two distinct types-mechanical and specific. Mechanical adhesion occurs when the surface or adherend to which the adhesive is applied is so roughed or abraded that it is, in effect, a multitude of irregularly shaped jagged holes and projections so that, when the adhesive is applied, it flows in and around these holes and projections and dries or cures to form an interlocking joint with surface and adhesive one homogeneous mass.

Specific adhesion, on the other hand, does not depend upon simple interlocking of surface and adhesive. It comprises chemical or physical forces between the adhesive and the adherend with such an attraction that attachment occurs regardless of whether the surface is rough or smooth.

As late as ten years ago there was still a widespread belief that mechanical adhesion was of major importance. but the work of McBain in England and Browne and Truax in this country made evident that, in the glueing of porous materials, adhesion is to a high degree specific and not simply mechanical. Microscopic examination of sections of glued joints indicated that glues dried or cured in the pores not by shrinking to thread-like films, but rather adhered to the walls of the pores, leaving a thin layer and forming a hollow cylinder, sticking to the walls The advantage, of course, of a roughed or abraded surface is that the surface area available for adhesion is tremendously increased.

The question of the forces which come into play in specific adhesion is far too complicated to get into in any detail in this paper. It is enough to say that polarity is far too simple an explanation, and that molecular forces, induction forces, and electrostatic forces all exert an appreciable effect on adhesion to surfaces. It is extremely doubtful whether primary valence forces are of any importance in adhesion.

With the tremendous variation in types of materials to be adhered to

one another, particularly in the shoe industry, where style is a major factor, it is of great importance that some of the theoretical considerations be recognized since otherwise service failures will result.

Shoe Industry Adhesives

Generally speaking, approximately 90% of all women's shoes are made by the adhesive process—that is, adhesives are used to attach soles to uppers. Approximately 50% of children's shoes and 25% of men's shoes likewise fall into this category. In virtually all types of shoes, however, adhesives of some sort play a major part, whether for attaching fabrics to leather in a combining operation or in many other applications.

Adhesives used in the shoe industry can be divided into three general categories, both from an end-use standpoint and from a physical state standpoint. For such operations as attaching the counter, attaching the sock lining which is the insole covering, combining of doubler fabrics and the like, latex adhesives are used. This type of adhesive is generally considered a non-structural type, with the operation primarily a pasting one. The adhesives used for these operations are usually highly extended neoprene or natural rubber latices having considerable wet tack.

For the lasting operation where a semi-structural type of adhesive is required, resin-modified neoprene or natural rubber latices are used. This operation takes place when the upper material is folded over the insole prior to adhesively attaching the sole to the folded-over portion of the upper. These lasting adhesives are considered semistructural since they must possess a high degree of tack while, at the same time, they must have good heat and good solvent resistance, because the adhesive must hold during other shoemaking operations where heat and solvents are employed until such time as the sole is cemented to the upper and holds the entire assembly in place.

The second general category of adhesives used in the shoe industry is of relatively little importance. These adhesives are hot-melt types applied to metal or wood shank pieces to hold them in place. These adhesives are also used to cement forepart fillers and the like where no stress is put on the bond. These adhesives generally are oil-modified rosin derivatives and have no great inherent strength.

The most important category of adhesives in the shoe industry is the

sole attaching type, whether permanent sole attaching or temporary attaching prior to stitching. These adhesives are solvent based and can be classified. particularly the former, as true structural adhesives in that they must possess high strength as well as resistance to many types of stresses.

The construction of a shoe, particularly a high-heel woman's shoe, can be likened to the span of a bridge. The shoe, in fact, is subjected to far more stress proportional to its size than is a bridge span! The shoe is exposed to heat, cold, and moisture in service while at the same time torsion, flexure, peel, shear, and tension stresses are applied.

Temporary sole attaching adhesives where they merely must hold the sole in position until it is permanently stitched to the upper are generally solvent-base natural rubber or pressure-sensitive neoprene adhesives. In some cases a high-strength resin-modified neoprene latex is used, but use of this type is far in the minority.

Permanent sole attaching adhesives are of four types: nitrocellulose, vinyl, neoprene, and nitrile rubber. All of these cements are designed for application by semi-automatic extrusion machines and, as such, cannot be of a curing type.

As a matter of interest, there is a great deal of opposition in the shoe industry to the use of curing adhesives even though their superior bond permanence is recognized. This opposition is attributable in part to lack of real technical skill in the industry itself, other than in the large shoe companies, but more so is due to the insistence of industry on high-speed operations combined with ease of application and long storage of parts prior to assembly.

When the cemented shoe was first developed in this country in 1928, nitrocellulose adhesives were developed for permanent sole attaching. materials in common use at that time were fabrics and leather for the uppers and leather soles. The adhesive was applied to the sole weeks and even months before it was applied to the upper. The nitrocellulose adhesive was allowed to dry on both sole and upper and was later activated with a solvent: then the parts were joined together and put under pressure. This type of adhesive was not thermoplastic and gave a bond highly resistant to stresses encountered in service. Failure of the bond, when properly made, was invariably occasioned by the use of inferior materials of shoe construction such as fleshy soles or weak fabrics. As a matter of interest, even today nitrocellulose adhesives are still considered a standard in the industry although their use is steadily decreasing.

Although rubber soles have been common to men's shoes for many years, the advent of the nuclear or thermoplastic rubber sole such as Goodyear's Neolite and the adaptation

of this sole to women's thin soles gave tremendous impetus to the use of neocements since nitrocellulose would not adhere to virtually any type of rubber sole. These neoprene cements were pressure-sensitive for a limited period and consisted of neoprene modified with soft resins. Although tremendous improvements have been made in pressure-sensitive neoprene cements since they were first developed, they are still basically of the same type. These cements, however, have fostered one change in the shoe industry in that they have enabled the manufacture of shoes on a conveyorized line basis. Admittedly, this is true only of the flat or play-shoe type of construction. In this method of manufacture the adhesive is applied to both sole and upper at the same time, and after forced drying, the parts are joined together under pressure for short periods

In cases where conveyorized assembly is not used, the difference in drying cycle between sole and upper is considerably shortened—a matter of one day or two days, rather than weeks—but the adhesive is still used as a true pressure-sensitive type although its pressure sensitivity exists for only a limited period.

As an outgrowth of the pressuresensitive neoprene types, some high strength neoprene adhesives have been developed for high-heel shoes. These adhesives have no pressure sensitivity, but being highly modified with a hard resin, usually phenolic, are activated by heat. The cement is applied to sole and upper in the conventional manner, and, when the bond is to be made, the sole is subjected to heat so that the cement becomes tacky. Assembly is then made, and the shoe placed under pressure. This type of activation is now in general use in the shoe industry in virtually every case except with the nitrocellulose types and the pressuresensitive neoprene types.

During World War II, leather was virtually unobtainable, with the result that vinyl plastics came into quite general use for upper materials. The adhesives then in use in the shoe industry—nitrocellulose and neoprene—would not adhere to vinyls with the result that phenolic-modified nitrile rubber cements were developed. These adhesives showed satisfactory initial adhesion to the vinyl plastics then in use, but plasticizer migration resulted in literally carloads of shoes being returned to the manufacturer for bond failure after aging.

The first step in correcting this situation was the development of a vinyl adhesive sufficiently strong initially so that it could accept large quantities of plasticizer without materially weakening the bond. Unfortunately, this type of adhesive would not adhere to rubber so that it could be used only with leather soles. The technique of bonding used was the heat

activation type similar to that of the high-strength neoprene adhesives.

There was still a demand in the shoe industry for an adhesive compatible with vinyl plastics and nuclear rubber soles. As a result, vinyl plastics were developed with plasticizer migration at a minimum, and improvements were made in modifying nitrile rubber adhesives, with the result that today bonding of vinyl plastics to rubber can be conducted with a considerable degree of safety.

Flooring Industry Adhesives

The problems of adhesives in the flooring industry are quite different from those encountered in the shoe industry. The degree of specific adhesion to the flooring material need not be so pronounced as is necessary with shoes since the bonding area is so great; yet in one respect tremendous stresses may be encountered. These stresses occur when the floor covering is laid below grade with the result that water under hydraulic pressure is forced against the entire bonding area. On occasions of this sort either tremendous specific adhesion is required, or the adhesive and floor covering itself must permit rapid passage of moisture vapor through so that the bond is not destroyed. Otherwise the floor covering is mechanically pushed away from the flooring, and bond failure results.

Another factor which is extremely important in connection with the attachment of floor covering is the resistance to cold flow. Subjection of flooring material to hot and cold cycles will result in flooring material creeping if the adhesive used is subject to cold flow, which is manifestly undesirable.

Ease of removal of the floor covering is also a prime consideration, and, as a result, an extremely high-strength adhesive causes considerable trouble when the covering must be removed for replacement.

Materials generally used for floor coverings consist of linoleum, either in tile or sheet form, asphalt tile, rubber tile, and vinyl tile.

The linoleum type of floor covering is by far the oldest type, and techniques used for adhesively attaching it to flooring, whether in the tile or rug form, have been well worked out over the years. Conventional linoleum paste of troweling consistency is nothing more than residue from the sulfite digestion of wood pulp, dehydrated to 50% total solids, then extended with This type of adhesive is water soluble, but, since linoleum is quite permeable to moisture, diffusion of the water vapor in the adhesive through the linoleum is relatively rapid. This adhesive can be cleaned from the linoleum with water.

There is another type of adhesive classified as water-resistant, which is also used with linoleum. Usually this adhesive is a Vinsol or manila resin solution in alcohol, extended with clay filler. This type of adhesive can be cleaned by use of alcohol which will not attack the linoleum, and, as mentioned previously, it is waterproof. Frequently an adhesive of this sort is used in conjunction with the standard linoleum paste with the latter being used for a major portion of the bonding and the waterproof adhesive being used along the edges. In this manner loosening of the floor covering, when scrubbed with water, will be eliminated.

Asphalt tiles are somewhat in a class by themselves since they are considerably harder than any other floor covering generally used. In this case, cold flow is not too great a problem because of the rigidity of the asphalt tile with the result that asphalt emulsions modified with clay of the bentonite type are generally used for attachment. Adhesives of this type are generally of troweling consistency.

The use of adhesives of troweling consistency obviates one large problem in attaching floor coverings by adhesives-namely the roughness of the flooring substrate. When for a number of reasons adhesives of this type cannot be used, it then becomes necessary for a different technique to be employed. Generally, this technique consists in the use of a base material, either an asphalt inpregnated felt, a non-woven fabric or paper which is adhesively coated on both sides and to which the floor covering adheres. This technique has an additional advantage that, if the floor covering must be removed, the base material usually splits, and the covering is easily removed.

Rubber tile is usually laid on concrete and occasionally other substrates, with a two-part adhesive consisting of a compounded synthetic rubber latex, usually SBR, and Lumnite Cement. The two parts are mixed prior to application, and the tile laid on the resultant base. The water in the latex hydrates the Lumnite Cement and causes it to harden while at the same time the latex contributes some degree of specific adhesion and tack to the composition. This type of bond provides a waterproof and exceedingly strong bond. In some instances, phenolic resins and Portland cement are used with a combination of alcohol and water for the same purpose. Solvent based adhesives are not generally used for field application because of their swelling tendencies on the tile.

When rubber tile is to be laid on wooden flooring substrates, another technique is sometimes used. Modified butyl rubber or tacky acrylic adhesives are applied to the tile in the factory, and slip-type paper treated with separating lacquer or silicone is placed over the adhesive treated surface. When the tile is ready to be used, the paper is stripped from it, and the tile laid on the flooring.

In other instances as mentioned previously, paper or non-woven fabric is coated on both sides with permanently



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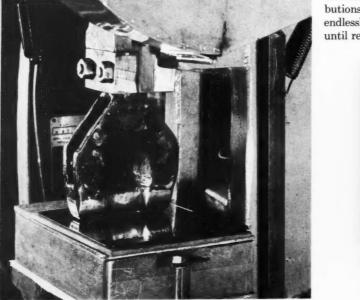


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pressure-sensitive adhesives and covered with separating sheets of a sliptype of paper. The slip paper is removed when the tile is to be laid, the adhesive-coated paper placed on the floor, and the tile then bonded to the top side of the adhesive-coated paper. Both of these methods obviate the necessity of using solvent-base adhesives in the field.

Adhesives generally used for vinyl tile are the permanently pressure-sensitive polyvinyl ether types. Here again the techniques used generally follow those used for rubber tile in that the tile may either be coated by the manufacturer or may be bonded by the use of an adhesivly coated paper. For those instances where plasticizer migration might take place or where an extremely durable bond is needed, a nitrile rubber latex-casein combination is sometimes used. This type of adhesive is also used in the factory for joining asphalt-impregnated paper to various types of floor covering where cold flow must be eliminated. It is an extremely effective adhesive for a job of this sort.

Automotive Industry Adhesives

Adhesives in general use in the automotive industry can be characterized as either sealants or structural types. In those cases where the bond is not stressed such as weatherstripping around windshields and the like, pressure-sensitive adhesives of butyl rubber or neoprene types are generally used. On the other hand, where the adhesive must function as a truly structural member, either air cured or heat cured adhesives are generally used.

Permanently pressure-sensitive adhesives of the butyl rubber or reclaimed rubber types are also used for attaching door-panel coverings where these panels are later clamped in place. As a matter of interest, the use of hot-melt adhesives of the polyvinyl acetate type are currently being tested in conjunction with semi-automatic machinery for folding and bonding these coverings to doors. This type of adhesive can be classified as a non-structural type although it is not truly a sealant.

A very important structural application for adhesives as a replacement for riveting is in the bonding of brake bands to steel backing. These adhesives must withstand temperatures of 600° F, or higher while they are at the same time under tremendous shear stresses. The adhesives generally used for these purposes are highly modified phenolic or epoxy types which are first air cured and then baked to obtain maximum adhesion.

Last, but not least, are the adhesives used for bonding weatherstripping to the doors and windows. With the old type of compression weatherstripping, closing of the door or window actually applied pressure to the bonded area with the result that permanent tacky adhesives of the, butyl rubber or reclaimed rubber types could be used, although

usually a neoprene adhesive of limited pressure sensitivity was used. Since the door held the stripping in place under compression, even the paint baking operation would not cause bond failure.

With the adoption of the cantilever type of weatherstripping construction, the bond was put under peel stress and a relatively weak, permanently pressure- or heat-sensitive adhesive could no longer be used. Instead curing-type phenolic-modified neoprene adhesives were adopted. These adhesives have limited pressure sensitivity, after which they develop a tough, resilient bond. During the paint baking operation, the heat reactive phenolic resin combines with magnesia to form a modified resin having no melting point, which in turn confers heat resistance to the adhesive. This, incidentally, is a patented composition for the practical area of resin modification.

Questions and Answers

Q. What type of adhesive is suggested for "on grade" and "below grade" rubber tile installations? Briefly, how are they compounded?

A. For "on grade" installations, synthetic rubber adhesives are often used, and for "below grade" installations the two-part system using Lumnite Cement and modified SBR latices are used.

The problem of "below grade" adhesion has not been completely solved. My own laboratories have been working with highly modified epoxy adhesives for this type of adhesion because epoxy adhesives have good adhesion to concrete whether it is wet or dry.

Q. In connection with the adhesion of soling, if two pieces of material are cemented with adhesive and then tested for adhesion at room temperature, even though the force required to separate the two pieces is large, the cement film pulls away from one or the other of the material surfaces rather cleanly. What significance would you attach to such behavior in connection with the service of the soling material on shoes?

A. Very frequently this type fo peeling can be attributed to the presence of silicone mold release agents on the surfaces of the material being bonded. We have found slight traces of silicone release agents where sanding belts are used in the buffing and roughing operations in shoe plants; the release agents are transferred from one batch of soling stock to another by the belts with the likelihood of being the cause of spotty adhesion. If silicones are not to blame and peeling of the test strips still occurs, close examination of the peeled-away cement film may show small particles being pulled away from the test strip which appeared to have peeled clean. This phenomenon is true particularly with high-strength soling stocks. In a 180-degree peel test, you might get an extremely high pull value due to a leggy adhesive so that you are

effectively pulling over an area rather than over a straight line as the strip is peeled.

For flat or play-shoe type of construction, we feel that an adhesive that will give a peel test result of about 12 to 15 pounds is adequate. For high-heel shoes, we consider 20 pounds or more a minimum on the same basis. These values are determined on a Scott Testers machine with a jaw separation of two inches per minute using a one-by six-inch test strip after the bond has aged 24 hours.

In connection with test work on soling stocks, failure of the stock frequently occurs along a portion of the strip; then the adhesive apparently peels. As mentioned above, if the adherend surface is clean and free from mold release agents, what appears to be peeling is actually the tearing away of small particles of rubber from the roughed surface of the test strip.

Q. What are the specifications on adhesion for flooring; what are the types of adhesive to use and the methods of use?

A. I am not familiar with any special specifications for adhesives for flooring.

Q. Describe methods for rubber-tometal bonding in the cold.

A. I presume that the semi-structural or structural type of bond to rubber that has been vulcanized is referred to here. The use of conventional pressure-sensitive adhesives involves only application of the adhesive, allowing it to dry and placing the two parts together under pressure. With rubber-to-metal bonding of this type, you have two impervious surfaces, which condition presupposes that at the time of contact you have 100% solid materials as the bonding medium.

Normally, on the bonding of two impervious surfaces, adhesive is applied to both surfaces, is allowed to dry free of solvent, and then is later activated with heat with the assembly under pressure.

Q. Please discuss the use of polyisobutylene in pressure-sensitive adhesives on flat paper for coating Lucite acrylic plastic.

A. There is a great deal of polyisobutylene used either alone or in conjunction with butyl rubber for pressure-sensitive adhesives for kraft paper which is used to cover Lucite. Virtually all sheet stock of Lucite and similar materials is covered with paper and polyisobutylene adhesives. This type of adhesive has the advantage of not attacking the plastic since polyisobutylene is soluble in aliphatic solvents. Any contamination with aromatic solvents, however, will cause crazing.

There are some latex adhesives modified with polyisobutylene on the market, and since this is a water system, there is no danger of crazing of the plastic with such adhesives.

Rubber-to-Metal Bonding - A 1957 Inventory

Stewart L. Brams Dayton Chemical Products Laboratories, Dayton, O.

DURING the year 1957 most of the commercial polymers were bonded to metals during vulcanization, and virtually all constructions in which metal plus polymer construction is desired have been or can be made by some means or other during the molding of

the polymer.

For those not already familiar with the numerous classes of products made today involving rubber and rubber-like materials joined to metal during molding, some of the major classes are as follows: functional sandwich-type assemblies which include automotive and other mountings, exhaust pipe hangers, coaxial bushings, etc. Single-layer adhesions include tube valve stems, oilseal rings, bumpers, industrial wheels, oil-well parts, rolls, etc. Tank linings are a special case, as are rubber covers for accelerator pedals. etc.

In the list of polymers given below, which in 1957 were being bonded to metals during vulcanization, estimates of the relative volume of bonded parts are indicated by letter and estimates of the relative quality of the bonds by

number.

Natural rubber (NR)	A1
Styrene-butadiene rubber (SBR)	A1
Neoprene (CR)	B1
Nitrile (NBR)	B1
Butyl (IIR)	B1
Urethane polymers	C1
Thiokol rubbers	C1
Hypalon ¹	C2
Polyacrylic rubber	C2
Silicone rubber	C2
Fluorinated rubber	D3

Metal surfaces being bonded successfully include most of the commonly used structural metals, as shown in the following list. These have been listed in approximate order of increasing difficulty of obtaining bond, but all have been bonded successfully for at least some applications.

Mild steel Alloy steels Brass-plated steel Solid brass Stainless steel Decorative and Cast-iron protective plates Aluminum Lead Magnesium Silver Bronze Copper

Metal Preparation

Metal preparation was the subject of considerable study during 1957. For several years the standard of the industry has been, and continues to be, grit- or sand-blasting. For economic reasons much study has been directed

¹ Chlorosulfonated polyethylene, E. I. du Pont de Nemours & Co., Inc., Wilmington,

toward the replacement of this process with a lower cost method, mainly to achieve mechanical handling and processing instead of the manual handling required with blasting. Some plants have achieved limited success using phosphate coatings on the metal, which process can be conveyorized with only one racking of the insert from the time it is taken from the tote box until it is ready to go to the press line. Degreasing, chemical treatment, rinsing, drying, and cementing (one coat or two coats), all are handled in continuous fashion with no handling of insert other than initial loading and final discharge from the conveyor hook.

Other plants have investigated the use of special cleaning solutions, which are more economical than the phosphate coating. Adhesion systems have been tested in an attempt to secure adhesion on cold-rolled steel with degreasing only. The situation can be summed up as follows. For optimum adhesion on production scale. gritblasting is still the standard, the preferred and proven method, when size of grit and cleanliness are controlled. Small savings can be realized where chemical coatings or cleaners can be applied on fully conveyorized basis. along with cement dipping: however not all stocks and metals can be bonded successfully, and in fact, up to now, the system is not relied upon for optimum bonding in most plants which now use the process at all. Greater savings could be realized from the use of other chemical cleaners, but these are limited to non-functional applications in most plants attempting to use same today. Brass-plated parts are prepared for plating by grit-blasting in some cases, or by chemical cleaning in others, and often by both. Chemical cleaning in such cases is conveyorized with the plating set-up, and costs no additional labor. Knurling or machining of metal surfaces is confined to jobs using a hard rubber interlayer and, in fact, is to be avoided when other adhesion systems are used.

Adhesion Methods

Brass plate still accounts for perhaps 20% of the bonded parts being made today. It is estimated that 60% of bonded parts are being made with twocoat adhesion cement systems, using primer and secondary coating of bonding agent and sometimes an additional coat for safety, or building tack. Perhaps 20% of parts are made by application of a one-coat adhesion cement system. These figures are personal estimates only and cannot be backed up by any data. They do not include the pieces or parts made using hard rubber interlayer, or the few cases where mechanical means are relied upon for adhesion, or cases where plating other

than brass plate is used to promote some degree of adhesion on certain non-functional parts, or in the production of the tube valve stems, where a dip on the solid brass, without cement, can be used to develop adhesion.

The hard rubber interlayer method still finds favor in manufacture of certain large, heavy-duty rolls for paper and steel-mill use. In this method the hard rubber stock is wrapped around the mechanically threaded or knurled metal core: then the soft rubber stock is wrapped tightly around same. After curing, the hard rubber shrinks to a very snug friction fit, with the soft rubber spliced to the hard rubber core.

In regard to one and two or more coat adhesion cement systems, it should be noted that the majority of all cemented parts today goes to the press line with a non-tacky cement film, and the stock is applied as the mold is loaded. Formerly it was felt necessary to have a tacky cement film on the metal insert and perhaps to apply the rubber stock to it prior to delivery to the press line, but this practice has given way in many shops to the nontacky film method.

Stock Compounding

Compounding changes on bonded parts have been quite gradual over the past several years, and in 1957 we find, as before, that accelerators, "kickers," plasticizers, and sulfur content are the major points of concern. Stocks intended for bonding are usually compounded to meet certain specifications. whereupon attempts are made to bond them. In many instances this is the necessary sequence of events, since the stock specifications are rigid and narrowly defined.

In other cases, however, it is possible to modify the compound somewhat in order to improve its bondability. When adhesion problems are experienced, it is best to prepare a compound of known bondability, then make modifications designed to approach stock specification, at the same time watching carefully that bondabil-

ity does not suffer.

For natural and SBR rubbers, thiazoles are preferred over thiurams and carbamates in most instances. Small amounts of the latter-type accelerators as "kickers" have little or no deleterious effects, but when they are used as the principal accelerator, bonds are somewhat harder to obtain.

Low sulfur and sulfurless stocks also present a problem, and special care must be used in selecting the bonding agent. Excessive amounts of plasticizer have a detrimental effect on bonds. and while oil-extended SBR rubbers reduce compound cost, they often add to the difficulties of bonding. Plasticizers having exceptional solvent properties often cause adhesion problems. Excessive amounts of ester-type plas-

ticizers should be avoided if possible

when compounding neoprene (CR), both because of the direct effect on the bond, and because of the tendency for this type of plasticizer to accelerate corrosion of the metal (steel, aluminum, etc.). Activators such as NA-222 sometimes have adverse effects on bonds. In some instances, the addition of a small amount of sulfur to neoprene compounds improved the bondability

of the stock. Certain low-temperature plasticizers used in nitrile rubber (NBR) compounds have adverse effects on bonds, as does the reduction of the sulfur used. In compounding butyl rubber (IIR), the use of metallic selenium has a tendency to impair adhesion. On the other hand, the use of red lead and quinones in many cases improves adhesion of butyl stocks.

Adhesion Testing

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Test methods for bonded parts have not advanced particularly in recent months. The basic ASTM³ button test for straight tension testing is now about 20 years old. More recently a strip test was designated by ASTM. This test has been simplifid by commercial laboratories to produce results which, while not numerical in the same sense as ASTM method values, are nevertheless wholly adequate for most internal purposes.

One test which has been most useful. developed by a commercial laboratory. but not adaptable to ASTM-type work. is the adhesion-distension test. A sandwich is molded using flat plates of steel approximately one- by three- by 3/16-inch in size, with approximately 1/8inch rubber bonded between the two plates. The top plate is then drilled and tapped, and a bolt introduced until it bears against the bottom plate. It is tightened to force the bottom plate away from the top plate, to develop a certain elongation, or a numerical pull on a torque wrench if desired. This part, with a sustained pull on it of perhaps several hundred pounds. can be subjected to all sorts of testing -solvent immersion, water immersion. aging, weathering, etc., without requiring additional bulky equipment. Failures induced while under this distention come very close to correlation with dynamic testing of actual finished

After lengthy consideration of the problems of adhesion testing, however, the writer can reach but one conclusion-any adhesion test is indicative only of the results to be expected in bonding a particular stock with a particular bonding system to a particular metal prepared in some specific way. with stock and metal of shapes and sizes under test, at cure time, temperature, and method used in the test procedure. Any extrapolation of test data to a different set of conditions is always subject to possible error, is not prima facie dependable, and, in fact,

we can say the same about the entire business of bonding rubber to metal as it looks to this writer in 1957.

Theory

Along the lines of testing, as well as attempting to explain the apparent discrepancies in bonding practice, a commercial laboratory has developed a "Theory of Intrinsic Adhesion"4 which is perhaps the only reasonable explanation and guide to interpretation of such results advanced to date. This theory is purely a hypothesis, based on the assumption that every bond which appears stronger than the stock itself has, in fact, an adhesion rating which is higher than the numerical result noted by the test procedure. If a stock has adhesion just equal to its own strength, it would be rated at an empirical 100. However, practically, bonds which produce rubber failure when tested are always above 100.

The optimum bond hypothetically obtainable with a particular cement. stock, metal, shape, time, and cure is usually subject to deleterious influences in actual practice. These may include variations in temperature, in time, in stock composition or uniformity, in metal surface treatment, cleanliness of stock and cemented surface, humidity, mold irregularities, thickness of cement coat, uniformity of cement, or perhaps other not-thought-of variables. These deleterious influences will tend to reduce the intrinsic adhesion of the bond. although perhaps after the reduction there is still enough adhesion remaining to cause 100% stock failure, or adhesion in excess of stock strength. Thus we can consider adhesion systems which have a hypothetical intrinsic adhesion under optimum circumstances which is far in excess of the strength of stock, or far above 100 or 100% if we use stock failure figures as a guide. Such systems will be able to withstand production variability without dropping down below the 100% mark; whereas other systems showing good in a laboratory check, but inadequate in day-in, day-out production do so because their intrinsic adhesion under optimum conditions is not far enough over 100% to withstand variations which bring it down below 100. This, in highly condensed form, is the theory of "Intrinsic Adhesion," and although of no immediate practical value, is nevertheless useful in considering the old problem in adhesion work, that of correlating laboratory tests with production experience.

Conclusion

This is adhesion in inventory, as of 1957. Advances during the past year or two have been subtle, but definite. The art is still highly empirical and

² 2-Mercapto-imidazoline, Du Pont. ³ American Society for Testing Materials, Philadelphia, Pa. ⁴ RUBBER WORLD, Apr., 1956, p. 85.

still resists all effort to reduce it to an exact science. Practical experience is still the key to success in bonding work, and any change in this atmosphere is not too much in evidence for the near future.

Questions and Answers

Q. We note a considerable loss of adhesion in rubber-to-metal bonding when the primers, after being applied to the metal surface, are exposed directly to the sun's rays. Could an additive be put in the primer to prevent this loss of adhesive properties on exposure to sunlight without affecting the original properties of the primer?

A. I would think that the use of a black pigmented primer would be less subject to this type of deterioration than would the use of clear or unpigmented materials. Also, the use of black pigmented secondary coat might be helpful since I doubt if such a black coat would exhibit this type

Q. Please discuss the use of adhesives for bonding silicone rubbers to metal.

A. I do not have direct experience with the bonding of silicone rubbers to metal, but comments from a number of colleagues in the mechanical rubber goods industry indicate that a small number of adhesive systems is being used satisfactorily for this assignment. Different types of curing agents seem to function satisfactorily, and the compounding of the rubber stock does not appear to be so critical as it may be with some of the more conventional polymers. Quite a number of metals are being bonded satisfactorily to silicone rubbers, but one company reported difficulty with brass and bronze.

Various metal-cleaning processes appear to be in use including degreasing. mechanical cleaning, and also certain chemical dips. Exposure to moisture should be avoided during the cementing process. Post-curing of silicone rubber-to-metal bonded parts may be necessary in many instances to obtain maximum adhesion, which point means that the adhesion after mold curing may not always be adequate to prevent damage when the part is removed from the mold.

Quality of the bond seems to be quite good, relatively, that is, in view of the generally lower tensile strength of the silicone rubber stocks. These silicone rubber-to-metal parts are evidently not being used for the highly functional applications which require the higher tensile strengths of the more conventional polymers. Successful bonds seem to withstand oil, water, and reasonably high temperatures just about as well as the silicone stocks themselves, although some bonding systems are not so good as the silicone stocks at elevated temperatures. Also, good bonds are obtained with silicone

stocks compounded by the silicone rubber supplier as well as with those compounded by the user from the silicone gum rubber.

Q. We are interested in adhering very hard nitrile rubber stocks to metal. Can you suggest a suitable adhesive, and will you discuss the compounding of such a hard nitrile rubber stock for best adhesion?

A. Hard nitrile rubber stocks are difficult to bond to metal. I have seen nitrile rubber stocks of the nature of ebonite bonded with some degree of success to metal, but it is difficult to tell whether the bond is adequate. You can prepare a test specimen and run a hacksaw blade down to the metal in two different places, chip away at it with a hammer and chisel, and see whether or not you can remove all of the stock or if a certain amount of it remains on the metal. I have seen cases where a certain amount of stock did remain on the metal, but I have vet to see one where you could not chisel some stock loose without snapping off more than the stock at the very tip of the chisel.

Possibly it might be feasible to prepare an assembly of this type by using a very thin section of a softer nitrile rubber stock, which would give a certain degree of flexibility, and would quite naturally splice on to the harder nitrile rubber stock and would also be capable of bonding by con-

ventional methods.

The preferred method of compounding for such a hard NBR stock would require that the hardness be achieved through pigment loading rather than high sulfur content. In order to get a so-called "rock hard" NBR, you would require pretty high sulfur, but you can develop hardness of 90 and above on the soft rubber scale with pigment loading. Highly loaded carbon black stocks can be bonded with conventional adhesives, but with ebonites bonding may become more difficult.

Q. In connection with the splicing of extruded stocks, I have noticed an apparent difference according to the pH of the cooling water used on the parts. Can you offer any explanation for this situation?

A. If a high pH water were used, we might suspect a deposit of mineral matter on evaporation of the water, and this alkaline deposit would accelerate the cure and tend to produce better splices. If the deposit were acid in nature, the cure would be retarded, and the splice less satisfactory.

It would seem that such effects might be quite small; yet if such differences are consistently observed, these effects might constitute a reasonable explanation, particularly if the splicing cure was just barely sufficient to produce a good splice. Q. Is it theoretically possible to get a rubber-to-metal bond with any oil-resistant rubber such as neoprene or NBR that is as good as the rubber itself under severe dynamic conditions, for example, a bond that would hold until the stock breaks up when the part is exposed at 250° F., immersed in ASTM No. 1 oil, and continually under load as in a rubber bearing.

A, I know of no reason why you could not get such a bond except that it would be a matter of trial and error and require tests with some of the many commercially available bonding agents designed for use with neoprene

With a problem of this type, the adhesion distension test bar mentioned previously should be advantageous in separating the successful materials from the unsuccessful ones. A very small compact test piece could be made, and a very practical distortion of the rubber achieved while it was exposed to hot oil for whatever period of time was desired.

In some cases you would have stock

failure after exposure to high temperatures for long periods of time, but I doubt if the oil would affect the NBR stock very much. Certain neoprene compositions and certain adhesive systems might be affected, but I do believe the problem is solvable.

Q. What type of adhesive systems are recommended for Hypalon tank bonding?

A. One method is to bond in a sort of wallpaper fashion a previously prepared sheet of Hypalon to a metal tank side. This method would not be the preferred one of lining a tank with rubber, but might be satisfactory in some instances. The other method involves applying the Hypalon and curing in place as conventionally practiced in tank lining work.

I do not know of any successful tank lining with Hypalon at present, but I do believe that laboratory preparation of bonded parts and bonding materials has progressed to the stage where tank lining with Hypalon is under investigation or soon will be.

DKG Cologne Program Scheduled for May 7-10

Deutsche Kautschuk - Gesellschaft (German Rubber Society) will hold its 1958 Rubber Conference in Cologne, Germany, May 7-10. An exhibition of rubber processing and testing machinery and equipment will again be held in connection with the conference. Farbenfabriken Bayer, Leverkusen, will provide a tour of its plant and a fashion show for the ladies and a social evening, May 8.

The program of papers to be presented is listed below:

- 1. "Vulcanization of Styrene-Butadiene Rubber by Gamma Rays." Arnold, Kraus, and Anderson, Jr., New York,
- N. Y.
 2. "Planning and Construction of the Bunawerke Huls, G.m.b.H." Bauman, Marl-Huls, Germany.
- 3. "Mechanism of Vulcanization." Dogadkin, Moscow, USSR.
- "Petrochemistry and Rubber Synthesis." Holzrichter, Leverkusen, Germany.
- 5. "Deuterium or Heavy Hydrogen Rubber." Waldo Semon and David Craig, B. F. Goodrich Co., Brecksville, O.
- 6. "The Colloid-Phase Carbon Reinforcement of Rubber." H. A. Braendle, G. L. Heller, and J. W. White, Colombian Carbon Co, New York.
- 7. "The Influence of the Chemical Nature of the Surface of a Filler upon Its Reinforcing Properties." A. E. Brooks, F. W. Boggs, and R. H. Ewart, United States Rubber Co, New York.
- 8. "Synthetic Rubbers in the Manufacture of Technical Products." Burow, Moscow.

- 9. "The Distribution Force Component and Slip in the Contact Surface of Tires." Cooper, Birmingham, England.
- 10. "A Method of Determining the Fitness of Rubber Mixes for the Production of Vulcanizates Free from Sunk Spots." Eccher, Milan, Italy.
- 11. "Activation of Light-Colored Reinforcing Fillers." Ecker, Leverkusen.
- 12. "The Union of Butyl Rubber and Carbon Black." Edwards and Storey, Polymer Corp., Ltd. Sarnia, Ont., Canada.
- 13. "Production of Buna Huls K in the Pilot Plant." Engel, Marl-Huls.
- 14. "Recent Experiences in the Use of Butyl Rubber in Tires and in Other Rubber Goods." J. L. Ernst, Enjay Co., Inc., New York.
- 15. "Rubber Flex Testing with Biaxial Straining". S. D. Gehman and C. S. Wilkinson, Jr., Goodyear Tire & Rubber Co., Akron, O.
- 16. "Friction of Rubber." Gough, Birmingham.
- 17. "Dynamic Behavior of Tires." Hofferberth, Hanau, Germany.
- 18. "Influencing the Static and Dynamic Properties of Polyamide and Polyester Cord Yarns by Treatment for Use with Rubber and for Vulcanization." Jehle, Frankfurt/M/Hoechst, Germany.
- 19. "Investigations on the Tear Strength of Vulcanizates." Kainradl and Handler, Vienna, Austria.
- 20. "Effect of the Fiber Structure on the Fatigue Resistance of Rayon Cord." Keil and Schulz, Pirna.
- 21. "Investigation of Flex Fatigue and Dampening Phenomena of Tire

Cord." Kemnitz, Köln-Weidenpesch.

22. "A Study of the Frosting Problem in Vulcanizates." Kluckow and Seeberger, Düren.

'The Relation to Temperature of the Mechanical and Stress Optical Behavior of Elastomers." Kruse, Hamburg, Germany.

24. "New Ideas on the Aging Prob-lems of Rubber." J. Le Bras, Paris,

25. "Kinetics of Sulfur Vulcanization with Accelerators." Lorenz, Hannover, Germany

26. "The Swelling and Shrinkage of Soft Rubbers." Luttropp, Schkopau.

27. "Calorimetric Measurements of Deformation Heat in Rubber." Muller, Marburg.

28. "New Methods of Recovering Monomers from Latex." Pech, Gottwal-

29. "Present Technological Status of Chemical Fibers Developed for the Rubber Industry." Pieper, Wuppertal-Elberfeld.

30. "Recent Developments in Special-Purpose Elastomers." R. R. Radcliff and M. A. Smook, E. I du Pont de Nemours & Co. Inc., Wilmington, Del.

31. "Performance Characteristics of Synthetic Rubber in Tires." Riehl. Goodvear.

32. (Subject to be announced.) Scheele, Hannover.

33. "The Problem of Measuring Electrostatic Charges." Umminger, Marl-

34. "Abrasion of Carbon Black-Filled Rubber Compounds." Vervloet. Delft, Holland.

35. "The Production of Natural Rubber." Wallich, London, England.

36. "The Significance of Free Radicals for the Reinforcing Process." Watson, Birmingham.

37. "Recent Investigations on Mixing and Dispersing Active Blacks in Natural Rubber." Westlinning, Kalscheu-

The chairman of the German Rubber Society is O. Giese; the vice chairman, G. Framandi; and the director. A. Titze.

Tlargi Hears Gage on Rubber-to-Metal Bonding

F. W. Gage, Dayton Chemical Laboratories, Inc., West Alexandria, O., addressed 100 members and guests at the February 4 technical meeting of The Los Angeles Rubber Group, Inc., at the Biltmore Hotel, Los Angeles, Calif., on "Rubber-to-Metal Bonding." The technical session preceded a dinner. attended by 265, where the new board of directors was named. Tlargi announcements were made, and Hugh MacDonald, Chief, Los Angeles Sheriff's Office, gave an interesting talk on

"The Sex Criminal."

At the dinner Presiding Officer A. H. Federico, C. P. Hall Co., presented a certificate of appreciation and a gavel to the immediate past chairman. R. N. Phelan, Atlas Sponge Rubber Co. It was announced that Tlargi has accepted 45 new members since the last meeting and at the close of the year 1957 had 764 members in good standing. In presenting current events, R. G. Luskin. Goodyear Tire & Rubber Co., chemical division, mentioned that the golf committee has announced it would have the March tournament at the Hacienda Country Club and the April tournament at the Thunderbird in Palm Springs.

Announcement of the Tlargi Rubber Technology Foundation courses was made by R. R. Coleman, educational committee chairman. Charles Kuhn, Master Processing Corp., associate chairman for 1958, announced that as a result of a recent ballot, the June outing will again be held at Las Vegas, Nev., as it was last year, at which time 328 were in attendance.

Mr. Gage, in his address, discussed primary rubber-to-metal bonds1 that are developed during vulcanization, emphasizing metal parts bonded with new specialty polymers. An abstract of his address follows.

Virtually all constructions in which metal plus polymer combination is desired have been made, or can be made, during molding of the polymer. Natural rubber and SBR are still the bigvolume polymers for these bonded assemblies, with neoprene, nitriles, and butyl usage steadily increasing, followed by the specialty polymers: the highprice fluorinated polymers bring up the

Regarding the relative quality of bond attainable, good to excellent bonds can be obtained with natural rubber, SBR. neoprene, CR: nitriles, NBR; butyl, IIR; polyurethanes and Thiokol, polysulfide rubbers using the bonding agents currently available. Hypalon (Du Pont's chlorosulfonated polyethylene). polyacrylates, and silicones are somewhat more difficult to bond; while the fluorinated polymers are the most difficult. For consideration of various metals, steel, iron, brass-plate, solid brass, and aluminum are the easiest surfaces to bond: while lead, silver, and copper are always difficult.

In producing high-quality bonded parts the preparation of the metal surface prior to bonding is an important factor. Some metal surface treatments include brass-plating, grit- or sand-blasting and, to a lesser extent, phosphate coating the surface. Brass-plate accounts for perhaps 20% of the bonded

parts being made currently. Of these an estimated 60% are being made with two-coat systems, using primer and secondary coat. Perhaps 20% of the parts are made by application of a one-coat cement system. One-coat adhesion systems are the cheapest construction, but top-quality bonds are often obtainable. Two-coat systems, comprising primer plus cover-coat, are considered to be the most reliable.

Stocks intended for bonding are usually compounded to meet certain specifications, whereupon attempts are made to bond them. Low-sulfur and sulfurless stocks present a problem, and special care must be used in selecting the bonding agent. In the case of neoprene ester-type plasticizers should be avoided if possible. The compounder must know which compounding materials have adverse effects on bonds when using a specific type of rubber.

Regarding testing of bonded parts, the ASTM button test is commonly used. Recently a new strip test was designated by ASTM.2 A test developed by Dayton Chemical Products Laboratories, which has proved most useful, but not adaptable to ASTM-type work, is the adhesion distention test. In this test a sandwich is molded, using flat pieces of steel one inch by three inches by 3/16-inch, with approximately 1/8-inch rubber bonded between the plates. The top plate is drilled and tapped, and a bolt introduced until it bears against the bottom plate. In this manner the structure can be tested in all sorts of environmental conditions.

Along the lines of testing, as well as attempting to explain the apparent discrepancies in bonding practice, the same company developed a "Theory of Intrinsic Adhesion"3 which is perhaps the only reasonable explanation and guide to interpretation of such results advanced to date. This theory is purely a hypothesis, based on the assumption that every bond which appears stronger than the stock itself has, in fact, an adhesion rating higher than the numerical result noted by the test procedure. If a stock has adhesion just equal to its own strength, it would be rated at an empirical 100. However, practically, bonds which produce rubber failure when tested are always above 100. The theory takes into consideration deleterious influences which tend to reduce the intrinsic adhesion of the bond, although perhaps after the reduction there is still adhesion in excess of stock strength.

Mr. Gage concluded by stating that the art of rubber-to-metal bonding is still highly empirical and still resists all efforts to reduce it to an exact science. Practical experience is still the key to success in bonding work and will probably continue to be so for

¹See Rubber World, Dec., 1957, p. 416. ²Ibid., Mar., 1958, p. 889. ³Ibid., Apr., 1956, p. 85.

CALENDAR of COMING EVENTS

March 18-21

Committee D-13, American Society of Testing Materials. Spring Meeting. Sheraton-Park Hotel, Washington, D.

March 21

Boston Rubber Group. Spring Meeting. Hotel Somerset, Boston, Mass.

Commercial Chemical Development Association. Annual Meeting—"The Commercial Impact of Synthetic Hotel Statler, New York, Rubber." N. Y.

March 27-29

Division of High-Polymer Physics, American Physical Society, Eighteenth Meeting. University of Chicago, Chicago, III.

New York Rubber Group. Henry Hudson Hotel, New York, N. Y.

April I

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

American Institute of Chemists. Annual Meeting. Ambassador Hotel, Los Angeles, Calif.

April II

Akron Rubber Group. Spring Meet-

April 13-18

American Chemical Society, National Meeting, San Francisco, Calif.

April 14-15

American Institute of Electrical Engineers, Rubber & Plastics Sub-Committee of the General Industry Applications Committee. Ninth Conference on Electrical Engineering Problems in the Rubber and Plastics Industries. Sheraton-Mayflower Hotel, Akron, O.

April 14-17

Design Engineering Show and Conference. International Amphitheatre, Chicago, Ill.

April 16

Washington Rubber Group.

April 18

Detroit Rubber & Plastics Group, Inc. Spring Meeting, Detroit-Leland Hotel, Detroit, Mich.

April 20-23

American Institute of Chemical Engineers and The Chemical Institute of Canada. Chemical Engineering Con-ference. Montreal, P.Q., Canada. April 25

Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa. Chicago Rubber Group.

May 6

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

May 7-10

Deutsche Kautschuk-Gesellschaft. Rubber Conference and Exhibition. Gürzenich, Cologne, Germany.

May 9

Buffalo Rubber Group and Ontario Rubber Section, CIC. Joint Inter-national Meeting. Hotel Sheraton Brock, Niagara Falls, Ont., Canada.

May 12-14

Eighth Canadian High Polymer Forum. National Research Council of Canada and Chemical Institute of Canada. MacDonald College, Quebec, P.Q.,

May 13-16

Division of Rubber Chemistry, American Chemical Society. Netherlands-Plaza Hotel, Cincinnati, O.

May 21

Washington Rubber Group.

May 28

Division of Rubber Chemistry, Chemical Institute of Canada. Convention. Royal York Hotel, Toronto, Ont., Canada.

New York Rubber Group. Outing. Doerr's Grove, Milburn, N. J.

June 6

Fort Wayne Rubber & Plastics Group. Summer Outing.

June 9-12

ASME. National Conference on Materials Handling. Public Auditorium, Cleveland, O.

Buffalo Rubber Group. Golf Outing. Lancaster Country Club.

June 13-14

Southern Rubber Group. Dinkler Plaza Hotel, Atlanta, Ga.

Boston Rubber Group. Outing. Andover Country Club. Andover, Mass.

June 22-27

ASTM. Annual Meeting, Hotel Statler, Boston, Mass. (D-11 and Subcommittees, June 25-27.)

June 27

Detroit Rubber & Plastics Group, Inc. Outing. Western Golf & Country Club.

July 25

Chicago Rubber Group, Golf Outing. Medinah Country Club, Medinah, Ill. August 5

New York Rubber Group. Golf Tournament. Wingfoot Country Club, Mamaroneck, N. Y.

August 22

Philadelphia Rubber Group. Golf Outing.

September 7-12

American Chemical Society. Chicago,

September 9-12

Division of Rubber Chemistry, ACS. Hotel Sherman, Chicago, III.

September 25

Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

October 3

Detroit Rubber & Plastics Group, Inc. Fall Meeting. Detroit-Leland Hotel, Detroit, Mich.

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

Buffalo Rubber Group, Fall Meeting. Hotel Westbrook, Buffalo, N. Y.

October 16

Boston Rubber Group. Fall Meeting. Hotel Somerset, Boston, Mass.

New York Rubber Group. Henry Hudson Hotel, New York, N. Y.

October 17-18

Southern Rubber Group, Roosevelt Hotel, New Orleans, La.

October 24

Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.

November 14

Philadelphia Rubber Group, Dance.

November 17-21

Eighth National Plastics Exposition. Society of the Plastics Industry. International Amphitheatre, Chicago, Ill. National Plastics Conference. Hotel Morrison, Chicago.

December 2

Buffalo Rubber Group. Christmas Party.

December 4

Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

December 12

New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.

WASHINGTON

REPORT

By JOHN F. KING

Special Stockpile Advisory Committee Report Suggests Major Policy Changes

The government's Special Stockpile Advisory Committee has come in with its verdict: the \$7.3-billion horde of strategic and critical materials in the defense stockpile is too unwieldy for nuclear-age mobilization planning. The Committee's recommended sentence is: stocked perishable items, including natural rubber, should be reduced.

Or so it would seem from a study of the so-called Pettibone committee report to the Office of Defense Mobilization issued in late January.

The blue-ribbon panel, made up of 12 business leaders, all with backgrounds of important government service, was appointed last October by Defense Mobilizer Gordon Gray to reappraise stockpile planning to determine if it met the requirements of the Atomic Age. It was chaired by Holman D. Pettibone, chairman of the Chicago Title & Trust Co. and head of the Rubber Producing Facilities Disposal Commission in 1953-55.

Report Interpretations

Rubber experts, even after a month of study of the report, differ as to its findings and recommendations. There is argument on both sides about whether the report would support an ODM move toward partial liquidation of the 11/4-million-ton rubber stockpile. Some of the experts, reflecting the rubber manufacturers' interest in the stockpile, are convinced the Committee findings are a mandate for eventual liquidation. Others, reflecting the rubber trade point of view, seem to feel that the Committee hedged its conclusions in such a way as to preclude anything more than a token attempt at stockpile reduction.

Here is how the two interpretations of the Pettibone report shape up:

The first holds that strict application of the key committee recommendation—that "all stockpile planning" should follow the new government policy of providing against shortages for a three-year instead of a five-year emergency—would mean at least a 40% cut, or a

minimum 500,000-ton reduction, in the rubber stockpile. The present rubber inventory was built up over the years in anticipation of a five-year shortage.

Supporting the "liquidation interpretation" of the Committee report are two other basic recommendations the advisers passed on to Mr. Gray. The first -No. 7 of the 10 separate findingsurges that perishables like rubber "in excess of the Greater Security Goals should be disposed of. . . . " The second—recommendation No. 6—urges ODM to seek "more flexible authority to dispose of surplus materials," both through its own initiative, and through amendment by Congress of the basic Stockpiling Act. The Committee made clear when it discussed disposal that it referred only to perishables, since recommendation No. 8 advises ODM to retain non-perishable metals and minerals "except when utilization of any portion of the excess . . . would be in the interest of national security.

The other, contrary, view of the Pettibone report which holds-or hopes -that rubber stockpile liquidation is still a long way off, selects Committee arguments that the government should seek a "higher degree of security" by discounting completely all sources of supply outside the general North American area." Paradoxical though this interpretation may seem, its basic argument, which can be strained out of the Pettibone findings, goes like this: If a "higher degree of security" lies in discounting offshore sources of supply, then it follows that a large natural rubber stockpile is not only warranted, but required. Afro-Asia. the world's chief source of natural rubber, could not be any farther "outside the general North American area.'

Underpinning this view are a number of passages in the Committee report. For one thing, when the Pettibone panel ultimately does bite the bullet and recommend that excess perishable materials be "sold or otherwide disposed of," it does so with the utmost of caution. Perishable disposal should proceed, the report says, only "when this can be done without causing serious

domestic or foreign economic disruption, or international political situations contrary to the interests of the United States." This important qualifier to the disposal recommendation takes in a lot of territory.

There is another persuasive prop to this argument: Congress will look long and hard at ODM proposals for broader disposal authority. There are no guarantees it will approve. One final argument supporting this view of the Pettibone report is: natural rubber prices actually rallied after its publication.

Government Decision Required

The Committee members who sat in on the hurry-up stockpile studyit spent just a little over eight weeks surveying \$7.3 billion in materials plus another \$5 billion in machine tools and outstanding purchase contract liabilities-have folded up the record books and gone home. Government staff members will say only that the Committee's "meanings" are in the 19-page report which, as paraphrased by one official state: "Where perishable goods are in excess of Greater Security Goals (that is, exceed anticipated deficits that would arise in a Korean-type emergency), the excess should be disposed of." He noted that the Committee declared it was not competent to say which perishables should be disposed of. This was because the Committee felt the government has responsibilities economic, political, and militarywhich go beyond the stockpile respon-

An answer on which of the interpretations of the Committee's report is correct—if either is—must await the findings of a higher court. The Pettibone report, according to ODM officials, will be voted up or down before early April by the departments of government directly concerned with stockpiling. This means the Departments of Defense, State, Treasury, Interior, Agriculture, Commerce, Labor, and the Budget Bureau, which speaks for the White House, will have a say in the matter of proposing changes in the Stockpiling Act.

It also is possible that once the interagency study is finished, some or all stockpile suppliers, such as the rubber industry, would be sounded out on their

¹Rubber World, Nov., 1957, p. 267.

views. This possibility was held out by the Pettibone panel in the conclusion that industry views "can be obtained more effectively by the government, especially if there has been disclosure of stockpile contents and an explanation of the stockpile programs as recommended in this report."

Detailed Recommendations

Apart from the recommendations touched on above, the Pettibone com-

mittee also urged:

(1) The establishment of two new stockpile goals for each of the 75-odd items stockpiled. The first and priority objective should be minimum goals that assume "reasonable reliance on all accessible overseas sources." The second—the "Greater Security Goal"—would assume reliance only on North American sources. Both goals would be based on the scaled-down "need" period of three instead of five years.

(2) Recourse to Congress for "more flexible authority" to dispose of surpluses. This would require (a) that the Stockpiling Act be amended to loosen Congress's veto on disposal operations, and (b) an end to the administrative policy of freezing surplus materials in the stockpile unless a whole inventory of materials is declared no longer needed for defense.

(3) Adoption of a new method for estimating emergency requirements "based generally on industrial consumption patterns, adjusted for emergency conditions. Additional provision should be made for major military and atomic energy programs, as well as for new and increasing uses of high-temperature and other special-property materials."

(4) Upgrading, "when feasible," of substandard stockpile materials. If not feasible, "these materials should be disposed of, when this can be done without undue interference with usual markets."

In terms of "new directions" in stockpile policy, the panel recommended:

(1) Government efforts to insure "most effective uses of resources already in being" against an emergency. "This might include encouraging contracting and heavy construction industries, and public and private utilities and carriers, to maintain equipment beyond their normal needs."

(2) Encouragement of producers and distributors of medical, pharmaceutical, and hospital supplies to carry increased inventories at dispersed locations.

(3) An available pool of prepared food and potable water, protected against radioactive fallout.

The group also urged a shift in stockpiling emphasis from raw material hordes to finished items "and vital supplies for survival, relief, and rehabilitation." It said "energetic steps" should be taken to coordinate studies and initiate programs in this area. It also urged that the extreme secrecy surrounding current stockpile activities be eased off.

The Pettibone findings were set in the context of the Committee's conviction that existing material stockpiles "virtually eliminate the threat of raw material shortages of the type that impeded past defense mobilization efforts." The stockpile, moreover, now can "easily support an expanded defense industry for several war years."

"In previous wars, time and distance helped keep hostile attack from American shores," the Committee stated. "This may no longer be true. The protection afforded previously by ocean barriers may have vanished with the advent of new weapons and the means of delivering them."

Because industrial facilities are more vulnerable than raw-material producing facilities and inventories, it said, "the need for strategic and critical materials would be greater in a limited war, or in an economic or political conflict, than in a nuclear war."

The Committee study and recommendations, which were unanimous, did not mention individual commodities, but were confined to the consideration of broad policy questions.

NR Stockpile Tonnage Soon To Be Revealed?

The Office of Defense Mobilization may be obliged, as a result of the recommendations of the Pettibone Committee, to make public for the first time the exact amount of natural rubber in the defense stockpile. ODM's natural rubber inventory-one of Washington's worst-kept security secrets-has attracted the interest of the House Subcommittee on Government Information headed by Rep. John E. Moss (Dem., Calif.). The Subcommittee has been waging war with government censors who overzealously classify any and all odds-and-ends of federal information they believe might be of aid or comfort to potential enemies. The Moss subcommittee, further, has scored signal victories over the security mentality. For example, it recently broke the censors hold over such non-secret information as the commodity makeup and destinations of U.S. exports.

Since the publication of the Pettibone report, the Subcommittee has been pressing ODM for an "explanation" or "rationals" for keeping the rubber-stock size a secret. The subcommitee is aware

of the fact that the Reconstruction Finance Corp. disclosed the tonnage involved when it assigned wartime rubber stocks to the General Services Administration after World War II. It also is aware of the fact that with this basic figure, it is a simple matter for anyone to calculate the approximate size of the rubber stockpile. This is possible because the Commerce Department publishes monthly figures covering imports, consumption, and reexports in such a way as to spotlight a conspicuous stock disappearance during the period of stockpile accumulation. The generally understood size of the stockpile, thanks to the above formula, works out to about 11/4 million tons.

The Pettibone report itself urged declassification of most stockpile information, but not when (1) requirements might rise sharply; (2) military or atomic energy program information might leak out; (3) disclosure of shortages in goods supplied from vulnerable foreign sources might precipitate hostile acts; and (4) the government's negotiating position might be compromised.

FTC Schedules Tire Advertising, Price Fix Hearings; Congress Studies Price Problems

Federal Trade Commission trial examiners will hold public hearings in two cities in March to take testimony that will figure importantly in FTC's investigations of rubber industry tire advertising and marketing practices.

Complaint against Firestone

On March 13, hearings opened in Akron, O., on FTC's complaint against Firestone Tire & Rubber Co.'s alleged advertising misrepresentation of its second-line tires as first-line products, which are used as original equipment by auto manufacturers. "Typical" Firestone advertisements FTC alleges to be false include such phrases as: "Tire designed for original equipment on 8 million of America's finest cars—Firestone Super Champion" and "The tire

that was original equipment on 8 million new cars as they left the factory. Same tread design *PLUS* Modern Improvements—Firestone DeLuxe Super Champions."

FTC charged that the "truth is . . . these two brands are second-line tires and are not now, and never have been, used as original equipment; rather Firestone's 'DeLuxe Champion,' a first-line and 100-level tire, is the one which automobile manufacturers use as original equipment." Furthermore, FTC claims, Firestone's use of the names "Super Champion" and "DeLuxe Super Champion" is confusion and misleads the public into believing these tires are superior to the "DeLuxe Champion."

Such practices, FTC charges, unfairly divert trade from competitors in violation of the FTC act. Firestone promptly replied to the agency's January 29 complaint. The company announced in Akron that it denies any misrepresentation in its tire advertising. It stated: "The Firestone advertisements questioned by the FTC are truthful and forthright. We have delivered to the buying public exactly what we have advertised, and we are prepared to uphold our position when the opportunity presents itself..."

In its Firestone complaint, FTC noted that it still is in the process of finalizing an 11-point tire advertising guide to insure "truthful and meaningful" tire promotion.

The tire advertising guide was prompted primarily by FTC concern with the type of false advertising it charges to Firestone in the January 29 complaint. Promulgation of the 11-point advertising code is designed, according to FTC, to protect both the consumer and industry interests in the \$2-billiona-year tire trade. Finalization of the rules will await FTC study of industry comments.

Complaint against Thermoid

The second public hearing, scheduled for March 18 in Trenton, N. J., involves FTC's February 7 complaint against The Thermoid Co. for alleged discrimination in the prices it charges its customers for auto replacement parts it produces. Among the companies getting unfair Thermoid discounts, according to FTC's complaint, are Goodyear Tire & Rubber, B. F. Goodrich, and United States Rubber companies. In addition, the complaint charges, these three companies, as "private brand customers," have received even more favorable price discounts from Thermoid. Specifically, Thermoid is charged with rebating to so-called "group-buying jobbers" 15% on goods they resell, while "independents" get a rebate only on goods sold to other iobbers.

As yet, FTC has not moved in with price-fixing complaints against the rubber companies themselves, as has been anticipated. Expected targets of the price-fixing orders would be the three firms listed above, plus Firestone and a group of smaller rubber firms which would be named as coconspirators.

Senate Interest

Also on the price-fixing, false-advertising scene is the Senate Small Business Committee's abiding interest in these matters. While Committee public hearings on tire marketing practices appear no closer to reality than before, the inquiry still is listed on the Committee's agenda. The panel in mid-February issued its eighth annual report over the signature of its chairman, Sen. John Sparkman (Dem., Ala.). The Committee capped its review of 1957 small business activity with a set of five recommendations to enhance the posi-

tion of smaller companies in the economy.

Briefly outlined, the findings would (1) extend the life of the Small Business Administration and authorize the SBA chief to sit in on all Cabinet meetings that touch on economic affairs; (2) increase the small business share of military contracts; (3) ease tax burdens on small companies; (4) apply the anti-trust laws so that violators would get "hit harder"; and (5) improve statistical data on small business activities.

"Good Faith" Bill

Also on the question of price discrimination, the United States Supreme Court has upheld the "good faith" argument as an absolute legal defense against charges of violation of the Robinson-Patman Act when a businessman reduces prices selectively and in "good faith" to meet a competitor's price. The high court's 5-4 January decision in the Standard Oil of Indiana

case has a direct bearing on S-11, the so-called "good faith" bill that has been of keen interest to all segments of the rubber industry. S-11, stuck fast in committee for more than a year, would specifically limit the good-faith defense in price discrimination cases brought under the anti-trust laws. The legislation is opposed by rubber manufacturers and generally supported by rubber distributors.

Congressional sponsors of the bill, led by Sen. Estes Kefauver (Dem., Tenn.) in the upper chamber and Rep. Wright Patman (Dem., Tex.) in the House, are still trying to pry the legislation out of committee pigeonholes for vote tests on the floor. Their hopes received a sharp setback, however, when one influential group they were depending on for support, the U. S. Chamber of Commerce, did something of a turnabout and voted almost 10-1 against the legislation. The Chamber's poll on S-11 showed 2,802 members against the bill as against 290 favoring it.

Rubber Product Tariffs Held; State Approves Sadlak Bill; Trade Act Limitation Likely

The government has given in, a little, to rubber industry insistence that tariffs were designed to protect domestic producers and should be so used. The government at the same time is employing all its resources to push through Congress a long-term extension of the Reciprocal Trade Program. with substantial new tariff-cutting powers, over the objections of rubber manufacturers. Because the rubber industry has strong allies in opposing reciprocal trade. it is likely the government will have to give in again and accept a watered-down version of the extension Act.

Rubber Rates Unchanged

Practically every product the rubber industry wanted the Treasury to exclude from the new valuation provisions of the 1956 Customs Simplification Act was dropped, according to the Department's January 28 announcement, which said the following rubber items will continue to have their tariffs computed on the old valuation basis, which means the actual rate of duty will not be reduced:

Boots, shoes, or other footwear (including athletic or sporting boots and shoes, but not including footwear commonly known as "Tabi" or "Jikatabi"), the uppers of which are composed of cotton, ramie, animal hair, fiber, rayon or other synthetic textile, silk, or substitutes for any of the foregoing, with soles composed wholly or in chief part of India rubber or substitutes for rubber; boots, shoes, overshoes, or other footwear; catheters; combs valued over \$4.50 per gross;

gloves; hose and tubing, polyethylene or polyvinyl chloride, having an inside diameter of less than 3%-inch; insulating material, rigid, in sheet or board form; corrugated floor matting rubber, in rolls; rubber packing sheets; chlorinated rubber powder; rubber sheeting used in facing tennis table paddles; rubber suits designed for underwater use: tires and tubes, except bicycle size; and gutta percha tissue.

If these commodities had not been included in Treasury's exception list, competitive imports would enter at rates of duty as much as 5% below statutory or even trade-agreement rates. This would have been possible because of the changed formula for computing duties that went into effect February 27 to streamline customs valuation procedures.

The chemical industry was in the forefront of the move to keep imports from receiving the new streamlined customs treatment. When Treasury's "tentative" exclusion list of goods was first issued late in mid-1957, only 380 chemical products were in the special exception categories plus the above rubber items and other goods.

The January 28 "final" list, however, showed that 530 chemicals will be excluded from the new, lower-tariff customs formula. Most of the additions are coal-tar colors and dyes, industrial and medicinal chemicals and intermediates. The rubber exceptions were on both the tentative and final lists.

State Approved Sadlak Bill

In a related field, the government is giving a little again on the perennial

rubber-soled footwear import issue. The State Department, frequently the chief obstacle to footwear-import restrictions, has approved of the Sadlak bill (HR 9291), designed to plug tariff loopholes that permit importers to outflank the American Selling-Price Principle set by Presidential proclamation in 1933.

The Sadlak bill probably will not be voted on by the tariff-writing House Ways and Means Committee until after the Committee finishes its work on President Eisenhower's Reciprocal Trade Program. Hearings on the proposed five-year extension of the controversial Trade Act will continue through March 20, and it should take the Committee another week or so to produce a bill to be sent to the floor.

Limited Trade Act Extension

The Administration has labeled the five-year extension of the Trade Act "must" legislation. It is the only bill of the session to be supported in open committee testimony by all Cabinet members. The President himself has gone out of his way in four messages to Congress to urge strongly its enactment. All this adds up to maximum effort on the part of the Administration to push the legislation through over bitter objections from industries such as rubber. There is, it should be added, equally strong, if not stronger, support from business for legislation.

But it would seem the cards are stacked against the Administration and its trade supporters in the contest. The recession has emphasized the role of imports in the displacement of domestic products; in a growing number of instances, particularly in primary products, like non-ferrous metals and minerals, the unsettling effect of imports is all too plain; and finally, it is an election year, and Congressmen know it is safest to vote "protectionist."

There is a widespread feeling the most the President will get is a twoor three-year extension of the Act and, instead of his request for authority to cut tariffs by 25%, only a narrowly circumscribed modicum of new tariff reduction authority.

The Rubber Manufacturers Association's Rubber Footwear Division has advised the Ways and Means Committee that there should be no extension at all—that the program be unceremoniously ended. The Footwear Division contended that the proposed legislation, as have past extension acts, involves an unconstitutional delegation of legislative authority to the Executive Branch. The Division also opposed Eisenhower's collateral request for legislation authorizing U. S. membership in the Organization for Trade Cooperation.

USTC New Schedule

In a final tariff development, the Tariff Commission set public hearings

for March 11 on its new chemical and related product tariff schedule. Known as "Schedule 4," the new grouping of chemicals and related products represents USTC's efforts to modernize U. S. tariff categories by pruning out "anomalies" and obsolete items and making provision for the newer products which have come on the market since the

existing schedules were first set up in the 1930 Tariff Act. Briefly, USTC under the terms of the 1954 Customs Simplification Act is trying to boil down the existing 15 commodity schedules into a simplified eight. Interested parties have been invited to make their views known on commodity reclassifications.

INDUSTRY

NEWS

RMA Traffic Committee Organizes A Rubber Shippers Association

The traffic committee of The Rubber Manufacturers Association, Inc., was authorized by the board of directors on January 30, 1958, to proceed with the organization of a Rubber Shippers Association. A non-profit organization, the new Association will have as its functions the pooling, consolidation, transport, and distribution of freight for its members to secure for them the benefits of carload, truckload, and other volume freight rates. The RMA traffic committee expects to have the Shippers Association in operation on or before April 1.

The Association will provide the traffic committee with the machinery to help rubber manufacturers combat their mounting freight costs, which have climbed more than 170% since 1946 and now amount to more than \$300 million a year. The purpose of the Association is to make lower volume rates available to all manufacturers who have occasion to ship products in less-than-carload lots.

With the approval of the RMA board for this undertaking, the traffic committee is proceeding to incorporate and set up the necessary operating machinery, according to the committee chairman, George Gwinup, whose group has been engaged for more than a year in perfecting the details of organization. Operations will be administered by a board of nine directors, and a small executive staff. The operation of consolidation and distribution terminals will be handled by firms presently engaged in that business, acting as agents for the Association.

Membership in the RSA is open to any manufacturer of rubber products and to makers of any goods in competition with non-rubber products manufactured by members.

New England First

The traffic committee will initiate operations of the RSA in the New England area. It will have consolidation terminals at Boston, Worcester, Springfield, Mass., or Providence, R. I. Distribution terminals will be located at Los Angeles and San Francisco, Calif.; Seattle, Wash.; and Portland, Oreg.

Similar consolidation terminals are planned later for New York; Buffalo; Trenton, N. J.; Philadelphia, Pa.; Akron and Cleveland, O.; Detroit, Mich.; Chicago, Ill.; and at any other locations where tonnage warrants.

It was reported that approximately 180 rubber manufacturers are eligible to participate in the New England area alone. Shipment potential from New England to West Coast destination is estimated at 40 million pounds a year, and substantial savings are envisaged on that volume of freight to members of the RSA through use of the pool-car system.

Truck Carriers Included

It is expected that truck carriers will play an important part in the consolidation and terminal distribution phases of the operation and eventually to a considerable extent in the intersity movement of this freight.

Inquiries as to participation in the RSA should be addressed to G. E. Gwinup, chairman, traffic committee, The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y.

Montgomery Ward Neoprene-Sidewall Tire Eliminates Ozone Cracking

A newly developed sidewall compound, containing neoprene synthetic rubber, has solved a severe automobile tire cracking caused by high concentration of ozone found in the southern California smog belt. Evidence of the success of a new tire developed for West Coast outlets of Montgomery Ward Co. was presented at a press conference in Los Angeles, Calif., on February 26.

Marketed for Year

The new tire has been marketed for a year, and based on retail sales and adjustment records of 27 Montgomery Ward stores in the southern California area, customer complaints of sidewall cracking have been virtually eliminated, it was said. Ward's tire division manager, John R. Sebastian, said he felt satisfactory proof that the adoption of the neoprene sidewall compound had solved the ozone sidewall cracking problem had been obtained. The higher cost, black neoprene sidewall tires are being offered at no increase in price.

The manufacturer built these premium-quality nylon tires at Montgomery Ward's request, and it is the first time that a special tire has been merchandised using neoprene in both sidewalls to combat the cracking problem caused by ozone.

Development Problems

E. G. Partridge, director of the Tlargi Rubber Technology Foundation at the University of Southern California, discussed the problem of ozone attack on rubber products in the Los Angeles area. He pointed out that ozone is a major cause of deterioration of natural and many synthetic rubbers and added that the ozone concentration in Los Angeles is often 10 times greater than in the average community in the United States. While Los Angeles is particularly noted for its smog and

ozone, the concentration of ozone generally over the United States has been increasing in urban areas in recent years.

Mr. Sebastian said that Montgomery Ward tire engineers had found the problem of ozone cracking to be most noticeable in their nylon cord tires, and it was found that the greater growth of the nylon cord under operating conditions put the sidewall rubber under tension as the cords stretched and aggravated ozone cracking.

Because the nylon tire was performing satisfactorily in all other parts of the country and because Los Angeles motorists had accepted nylon because of safety and other factors, Montgomery Ward asked the manufacturer of its tires to intensify its research in order to solve the weather cracking of the sidewall rubber. The tire development engineers recommended that a tire be built using a sidewall stock containing neoprene synthetic rubber made by E. I. du Pont de Nemours & Co., Inc. Their decision was based on the fact that neoprene had been used successfully in a number of products that required protection from ozone attack. It was estimated, however, that this specially developed stock would cost Montgomery Ward an additional 25 to 50c per tire, depending on the size.

Laboratory and plant chemists worked on the formulations late in 1956, and the newly developed stock was first put into Ward's tires in January, 1957. By March 1, 1957, all Ward nylon passenger tires sold in the southern California area had neoprene sidewalls, at no extra cost to the motorist.

In the previous year, adjustment records showed a large number of customer complaints recorded because of sidewall cracking. Since the new nylon tire has been merchandized, the sidewall problem has been virtually eliminated, according to Montgomery Ward statistics.

Army Report Emphasizes Value of Coral Rubber

Firestone Tire & Rubber Co.'s Coral Rubber, the synthetic polyisoprene replacement for natural rubber announced by that company in 1955, has been classed as "practically identical to natural rubber," in a recent report by the U. S. Army's Headquarters Quartermaster Research & Development Command, and "may make it possible to reduce stockpiling of natural rubber at a great saving of money and space."

The report was made public by the Office of Technical Services of the United States Department of Commerce and is entitled, "Evaluation of Coral Rubber (Cis-Polyisoprene)," by J. C. Montermoso, A. Wilson, and C.

B. Griffis of the Quartermaster Research & Development Command and is identified as PB 131232 by OTS.

Coral rubber is now in semi-plant production, which is one step above the pilot-plant stage and Firestone estimates that, in full production, the price of Coral will be "about the same" as that of natural rubber.

The announcement that Coral rubber had gone into pilot-plant production was made by Harvey S. Firestone, Jr., chairman of the Firestone company, on August 22, 1955, and it was stated at that time that tests made prior to 1955 had shown that Coral rubber had properties at normal and elevated tem-

peratures equivalent to those of natural rubber.

The Army report listed three conclusions which were as follows: (1) The compounded Coral polymer tested was practically identical to natural rubber in physical properties and aging characteristics. (2) The low-temperature behavior of the Coral rubber under stress was slightly better than that of natural rubber. (3) The low-temperature stiffening of the Coral rubber when not under stress was slightly superior at —30° F., but slightly inferior at —65° F.

Other physical properties, including abrasion index, compression set, and resilience of Coral rubber and natural rubber at room temperature are remarkably similar, it was said.

It was added that "the new synthetic rubber evaluated in this report will meet the use requirements formerly satisfied only by natural rubber. . ." The report stated further that "with the development of production 'know-how' of cis-polyisoprene, there is the possibility of complete independence from overseas sources of supply of natural rubber, as well as the possibility of reducing the costly (approximately \$20 million annually) stockpiling of natural rubber."

First URWA Demands

At a meeting in Cleveland, O., in late February, the AFL-CIO United Rubber Workers Union delegates from URWA local unions in the United States and Canada gave an indication of some of their aims in 1958 negotiations with rubber industry companies. The delegates called for liberalization of present contracts covering medical. pension, and insurance benefits, including a full-payment surgical plan.

One major demand will be full-payment, company-paid comprehensive surgical and obstetrical benefits program for workers and their dependents and pensioners and their dependents. Present surgical plans negotiated between the URWA and industry companies have a fee schedule which pays up to \$250.

The URWA notified Goodyear Tire & Rubber Co. on February 4 that it wished to renegotiate the pension and insurance plans now in effect. The terms of the present agreement concluded May 6, 1955, provide for a termination date of June 1, 1960, but with either party having the right to reopen for renegotiation by giving a 60-day written notice on or after February 1, 1958. If negotiations are not successfully concluded at the end of 60 days from February 4, then either party may terminate the pension and insurance plans and also the collective bargaining agreement by giving an additional 60-day notice to that



New Tex Trade Mark

Rubatex Trade Mark

The new Rubatex twins, shown in the accompanying illustration, are constructed entirely of closed cellular rubber products produced by the Rubatex division. Great American Industries, Inc., Bedford, Va. This device for telling industry about the many uses for closed cellular rubber also serves as the company's official patented trade mark. Standing 40 inches high and weighing 20 pounds, one twin is a traveling emissary of the company, appearing at trade shows and conventions; while the other Tex remains at Rubatex's headquarters in Bedford.

Tex is all closed cellular rubber. His eyes consist of microphotograph sections of Rubatex showing the millions of tiny rubber sealed nitrogen cells of which closed cellular rubber is composed. The eyes light up to tell the story of the unique construction which gives this material its light weight, moisture impermeability, and structural strength. Tex also tells his story by means of a tape recorder installed in his back

Mounted on a piece of insulation hardboard, an expanded rubber compound with the lowest thermal conductivity of any solid material. Tex is trimmed with the firm's crepe-shoe sole material and neoprene gasketing material used extensively in the automotive industry. His shoe laces were produced by the division's newly developed extrusion process; while his helmet symbolizes the use of Rubatex in athletic equipment and for other applications where shock absorbency is important.

Moving Sidewalk Fine

A moving sidewalk in Houston, Tex.. which transports visitors 114 feet across the Buffalo Bayou to the Houston Coliseum, has carried more than 2,000,000 people since installed in February, 1955. According to Francis R. Deering, until January 1 acting director of the Department of Public Properties for the city, the traveling sidewalk has lived up to all expectations

and has been accepted as a natural convenience by the public.

The widest conveyor belt ever used commercially to transport humans, this sidewalk is a product of B. F. Goodrich Industrial Products Co., Akron, O. The belt is 82 inches wide and travels at a speed of 132 feet a minute while rising 12 feet to deliver passengers to the Coliseum. The moving sidewalk has sidewalls three feet high that enclose the sidewalk on both sides. Its handrails are synchronized with the speed of the belt. Passengers step on and off the belt as if it were an escalator.

The belt is 230 feet long, %-inch thick, and has seven plies of fabric for interior reinforcement, according to Goodrich. A specially compounded rubber cover provides a scuff-resistant, easy-to-clean surface.

Kleinert Breakfast

A gross national product of \$500 billion by 1961, up from around \$435 billion now, was predicted by Warren D. Mullin, economist with Kiplinger Washington Agency. speaking before 1,000 merchandise managers and buyers at the annual notion breakfast held February 4 at the Hotel Sheraton-Astor, New York, N. Y., by J. B. Kleinert Co., New York, Mullin expects the early Sixties to be boom times, because of the great increase in new families, but he warned that the price of our better standard of living will be continuing inflation and rising taxes.

Speaking of the future of notions departments in the "golden Sixties." Richard M. Bleier, vice president in charge of sales at Kleinert's, pointed out that a big lift in profits would follow if stores made better use of space, using more exposed stock fixtures, and eliminated salesgirls behind counters. He believes the girls should be out in the aisles where they can help more customers in a shorter time. He also discussed automatic stock replacement systems, shorter work week, and growth of branch stores.

George de Witt: and Jo Sullivan, recently starred in "Most Happy Fella," appeared. Miss Sullivan was Alice in a skit on the Wonderland of Notions.

Crescent Reacquired

Milton C. Sapinsley, founder of The Crescent Co., Pawtucket, R. I., manufacturer of insulated wire and cable, and his son, John M. Sapinsley, have contracted to reacquire control of the company which they sold to Penn-Texas Corp. in 1953. The company was established in 1920 and expanded from automotive and radio wire and cable into a complete line of electrical, electronic, automotive, welding and mining machine cable—also appliance cord

sets. It operates the Lowell, Mass., division as well as the Carol Cable division.

Milton C. Sapinsley is chairman and treasurer, and his son is president, posts which they held prior to the sale to Penn-Texas and also during the period when the company stock was owned by Penn-Texas Corp. It was indicated that there would be no change of personnel.

Interlocking Drums

A unique new 55 gallon steel drum which interlocks with adjacent containers when any number are unitized or packed closely together has been developed as a means of saving space and reducing handling and shipping costs, by the Signode Steel Strapping Co. in conjunction with Vulcan Containers Inc., who will manufacture and market the new Uni-Drum container.

The key to the interlocking feature is the special design of the rolling hoops. These are slightly offset—alternately raised and lowered—on opposite sides of the drum. When unitized, a group of the new drums can be handled by a standard lift truck without the necessity of costly wood pallets.

Transit damage can be sharply reduced because the unitized drums contact each other at their six strongest points, reducing denting and deformation. Also, the rotation, vertical movement, and loosening which often result in scuffing and surface damage are minimized, it is further claimed.

The patented Uni-Drum containers cost no more than conventional 55-gallon drums, roll only on the hoops, therefore roll straight and can be guided easily, can be reconditioned, and can be readily intermixed with standard drums if necessary.

The drums are available with a variety of closures, accessories, and fittings, sanitary and corrosion-resistant linings, and decorated to meet individual requirements. Further information may be obtained from Vulcan Containers. Inc., Bellwood, III.



Vulcan interlocking drums

Goodyear Shows Videne Plastic

Announcement of a new plastic, Videne, and of plans for construction of a \$9-million plant at Apple Grove, W. Va., to manufacture the material was made at a press conference-luncheon on February 13 at the Ambassador Hotel, New York, N. Y., by E. J. Thomas, president of The Goodyear Tire & Rubber Co., Akron, O.

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Described as a completely new polyester laminating film that can be adhered under heat and pressure to a wide variety of end-products in a number of industries, the plastic will set off a chain reaction of new plant construction by Goodyear suppliers and customers amounting to additional millions of dollars. The new Goodyear plant, located on a 300-acre tract, will be a five-story structure occupying approximately 100,000 square feet of floor space. Engineering plans are being completed, and the facility is expected to be in full production by the early spring of 1959.

Videne A will be produced for direct or stretch-laminating applications in the textile, metal, wood, paper, plastic, automotive, and packaging fields, and as a special wrap, Videne TC, for ma-chine packaging of meat and other food products. The applications of the laminating material can be considered

Experiments to date show this new product has extremely high abrasion resistance. It resists outdoor aging to an extensive degree and has excellent adhesive, electrical, and forming properties, it is claimed.

The chemical nature of Videne A is described as an unoriented, amorphous, thermoplastic material which cannot be crystallized and differs from other plastics in two major respects. It can be adhered under heat and pressure to textiles, metals, wood, paper, and certain plastics without adhesives and will vacuum form or draw to the limits of supporting materials.

Limited production of the new plastic already is under way at Goodyear's facilities in Akron. The plastic is being furnished to commercial markets in two film finishes, clear and satin, in gages from two to seven and one-half mils. Commerical testing of the material started a year ago by several companies in the aluminum, plywood, chemical, furniture, graphic arts, decorative coated paper, and converter fields.

Goodyear's new film can be laminated to glass, fabric, cotton, wool, Dacron, Orlon, nylon, and Vinyon fabrics, plywood, electrical-grade papers, leather, rigid and semi-flexible plastics, and it can be embossed or printed. Once Videne A has been laminated to any of the above-mentioned substrata, it is important to consider the properties of the resulting surface as a functional part of the laminate as follows: excellent abrasion resistance, gloss control, resistance to



Sample rolls of Videne A polyester laminating film

water, alcohol, gasoline, oils, and greases, excellent interior and exterior aging, corrosion and fungus protection, and unlimited possibilities of style and

Unlike Videne A from which it is derived, Videne TC has unusual strength in an unsupported state, even at extremely low temperatures. It is described as an oriented or stretched thermoplastic coated material which is heat-shrinkable within a controlled temperature range. Possessing good transparency and being heat-sealable, it is believed to be the first shrinkable film with enough inherent rigidity and dimensional stability to be run on commercially available automatic packaging machines. The packaging film is being produced in 40-gage (0.0004-inch) at Akron facilities.

Argus Enters Europe

Argus Chemical Corp., Brooklyn, N. Y., enters the European market through alliances with two overseas companies. To develop world markets for its patented line of vinyl stabilizers and plasticizers, the company has announced that it has joined with Union Chimique Belge, Brussels, Belgium, in the formation of a new company and has made a licensing arrangement with Lankro Chemicals, Ltd., Manchester.

Union Chimique Belge is a major manufacturer of industrial chemicals in Europe. The new company, SA Argus Chemical NV, will manufacture and sell Argus products in Belgium, Holland, Luxembourg, Spain, Portugal, Italy. France, Germany, Austria, Greece, and Switzerland. The Argus tradition of comprehensive technical service and basic vinyl plastic research

Industry

will be continued abroad. Technical personnel will be trained here under Arthur Hecker, Argus's director of research and an international authority on vinvls.

Lankro Chemicals, Ltd., of Manchester, has been granted rights to represent Argus Mark stabilizers in all British markets except Canada and in the Scandinavian countries, under a new trade name, Lankro Mark. Lankro Chemicals is the second largest producer of plasticizers in England.

New H₂O₂ Plant

The new hydrogen peroxide plant of Canadian Industries, Ltd., at Hamilton, Ont., is now on stream, 18 months after initial construction began. On the site of the company's Hamilton works, the plant is C-I-L's second hydrogen peroxide plant; the other is at Shawinigan Falls, P.Q., where it has been manufacturing the chemical for the last 21 vears.

The Hamilton plant is said to boost the company's hydrogen peroxide production facilities to provide fully for all present Canadian requirements and for the foreseeable future. The hydrogen peroxide plant consists of approximately 30,000 square feet in two complete floors and three additional partial floors. It has a structural steel framework and asbestos lining.

Patent license agreements with the Becco chemical division of the Food Machinery & Chemical Corp., whose process is used in the new plant, provide C-I-L with full use of that company's technical service facilities.

New Halane Retarder

Recent laboratory tests at Wyandotte Chemical Corp., Wyandotte, Mich., have shown that Halane, 1,3-dichloro 5,5-dimethylhydantoin, is an effective rubber retarder at concentrations ranging from 2.0 parts down to as low as 0.1-part per hundred of rubber. It was shown that Halane effectively reduces scorch at processing temperatures, but does not prevent vulcanization at the higher temperatures.

The tests indicated that Halane produced no deleterious effects on physical properties or aging characteristics when tested on typical SBR and natural rubber stocks. Halane retarder was shown to be satisfactory for use in lightcolored stocks as it did not discolor or stain at high temperatures and under

ultra-violet light.

Although experience has shown that Halane may be safely incorporated in a number of formulations for numerous applications, the fact that it contains available chlorine makes some precautions necessary. Further information is available from the Michigan Alkali division of the company.

African Terrain Tests Rayon Tire Quality

Rayon cord tires, which carry the majority of America's cars over this country's highways and city streets, have proved more than equal to the worst terrain of roadless, back-country Africa, according to Adrian "Ace" Williams, well-known explorer and documentary film producer.

Williams, recently back in the United States from a safari in British East Africa and the Belgian Congo, took his rayon-tire-equipped trucks and passenger vehicles over 19,000 miles of the wildest parts of Africa. He refers to Africa as nature's last great proving ground.

He conducted the tire tests for American Viscose Corp., a leading producer of super rayon cord for tire manufacturers. The first public exhibition of the results of the safari tire tests were a feature at the National Automobile Dealers Association Convention in January.

Avisco cooperated with Williams in the safari test of rayon cord truck and passenger-car tires because the renowned ruggedness of the African terrain offered a convincing test of tire durability. Successful use under the torturous conditions in Africa, Avisco thought, proved rayon tires more than safe for roads in this country.

Williams' four vehicles—two sixwheel trucks, a landrover, and a lorry made the trek into Africa and back again without tire failure. The vehicles were loaded with cargoes of expensive photographic and sound recording equipment, camping supplies, and provisions for the crew of photographcrs, guides, drivers, and porters. With cargo space at a premium, only one spare tire for each vehicle was included.

Adding to the validity of the rayon safari was the aging of the rayon tires that occurred prior to the 1957 trek. The same tires and vehicles had been used by Williams during a safari in 1955 that covered the southeastern area of Africa between Capetown. South Africa, and Nairobi. Kenya. Tires accumulated about 16,000 miles of use on the trip. The vehicles were then stored, with their full weight on the tires, in a warehouse in Nairobi for two years, before use in the 1957 safari.

used to expand the capacity of Minnesota Rubber's tool and die division.

William Ecoff, owner and manager of Park Tool, will join the Minnesota Rubber organization as manager of the tool and die division. In addition, he will be in charge of metal research, a new activity established for research and development work in applications of metals in rubber components.

The tool and die division presently supplies dies and tooling for production of rubber parts and metal inserts for rubber products and is developing automated production machinery for rubber and plastic manufacturing.

The new purchase is the second major acquisition by Minnesota Rubber in the last 10 months. In March. 1957, the firm purchased General Industrial Products. Inc., now operating as the company's plastics and latex division. Minnesota Rubber Co. is a major producer of precision molded rubber parts and seals for American industry.

Sturtevant's Micronizers for Fine Grinding

Typical Grinding Data for Various Materials

			IN A COME . IMPROVED	N. N. I. S.	
Material	Mill Diameter, In.	Grinding Type		Solid Feed Rate, Lbs./Hr.	Approx. Avg. Particle Size, µ
Titanium dioxide	30	Steam	4000	2250	1/2
Sulfur	24	Air	1000	1300	3/4
Talc (varies)	30	Steam	4000	2000	2
Iron oxide pigment	30	Steam	4000	1000	2/3
Barytes	30	Steam	4000	1800	3/4

Sturtevant Mill Co.. Boston, Mass., has announced the successful fine grinding of particles to a half-micron in modified Sturtevant Micronizers, fluid energy mills with no moving parts. Making this theoretical reduction a reality marks the second major step in a few months in Sturtevant's accelerated attempt to perfect methods of fine grinding. The first was the start up of a fluid energy grinding pilot in April, 1957, for experimentation and custom grinding.

The Micronizers in which the testing took place operate on the principal of super-speed rotation of particles produced by jets of compressed air or steam, which causes violent impact of the particles and results in fine pulverization without attritional heat. The major use of Micronizers has continued to be the simultaneous dry grinding and classification of superfine solids to a degree impossible by other commercial machines. Tests have shown that certain materials behave in totally different ways when reduced to particle sizes in the lower micron range.

Material to be processed is introduced into the shallow grinding chamber through an opening near the periphery. Adjustments of feed rate and/or volume or pressure of the grinding fluid maintains product uniformity in the desired size range. While fines are collected and classified at the center of the grinding chamber, centrifugal force created by the high-speed jets tends to keep the coarse particles in the grinding zone until they are sufficiently reduced to move inward to the point of discharge.

Eight sizes of Micronizers are manufactured by Sturtevant. The two smallest are two inches and four inches in diameter and are used mainly for laboratory work. The largest model, 36 inches in diameter, offers a larger capacity.

Minnesota Rubber Buys Park Tool Co.

Park Tool Co., a tool and die manufacturing firm in suburban Minneapolis, has been purchased by Minnesota Rubber Co.. Minneapolis, Minn. The purchase involved total assets of Park Tool, which will be merged with the parent organization and its facilities

Diamond Alkali Expands

Promotion of Roger G. Richards to the post of sales manager of the plastics division, Diamond Alkali Co., Cleveland, O., a producer of polyvinyl chloride resins. and establishment of a new customer technical service department with increased application facilities were recently announced by the company. Both moves are part of a divisional program for broadening Diamond's plastics industry sales and technical service activities as a result of the company's recently expanded line of PVC resins.

Richards, manager of research and development for the division since April, 1955, succeeds Kemble S. Lewis, who has been given the important responsibility of organizing a new sales market research section in Diamond's commercial development department.

Also appointed were George J. Koch to the newly created post of manager of technical service, and Basil P. Gray, formerly with National Distillers & Chemical Corp., to the new post of manager of sales development. Both Koch and Gray will also be located at the company's offices in Cleveland.

License to Pirelli

Pirelli. Societa Per Azioni, largest and most influential rubber company in Italy, has been granted an exclusive license to make, use, and sell Ripple Soles in that country by Ripple Sole Corp., Detroit, Mich., according to Morton Hack, executive vice president of the licensing firm. Rudolf Hollaus, of New York, acted as intermediary, and the licensee was represented by Piolo Trotto, vice director of Pirelli.

Industry

Inflatable Rubber Bag

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A giant rubber bag that is used in constructing demountable homes is being used at the Glen Canyon Dam and Powerplant site, Page, Ariz. Newest tool in the construction field, the giant inflatable rubber bag raises the roofs and lowers the floors of demountable homes now being erected at the site for construction workers.

Designed and constructed by B. F. Goodrich Aviation Products for use in erection of demountable homes made by Transa Homes Corp., Fullerton. Calif., the airbag takes the place of a crane or 16 men previously needed to unfold the homes from their accordionlike pack.

The hinged roof section of each home weighs more than 2,000 pounds; the airbag's buoyancy in water will support 85,000 pounds. The bag weighs 80 pounds and folds into a package 36 by 36 by 15 inches.

Royalite Use in Boats

Royalite, a tough blend of rubber and plastic developed by United States Rubber Co., was introduced as a material for boat construction at the National Motor Boat Show where the rubber company had on display a ninefoot dinghy and a 14-foot runabout.

The company's scientists have come up with a five-ply construction built around a cellular or honeycombed center which they claim has five unique and important advantages for smallalite boats on the drawing boards and plan to introduce them for the 1958 boating season. Other companies are said to have expressed strong interest.

New Expansion Program

Announcement has been made by The C. P. Hall Co. of Illinois, chemical manufacturer, to the effect that expansion of the company's physical facilities, prompted by consistently in-creased demands for the company's products, is under way.

A new building, scheduled for completion early in April, is being con-



Royalite-hull runabout structed at 5245 W. 73rd St., Chicago.

Ill. The brick and steel structure, to have 21,000 square feet of floor space on a four-acre plot, will be used for offices and warehouse and will be so constructed that it can be enlarged at will to meet growth requirements. The Belt Railroad will serve the new building, being equipped with the latest in materials handling equipment, thus enabling the company to offer maximum

service to industry with its heavy

chemicals and chemical specialties.

It was also reported that the company's present building, at 5145 W. 67th St., Chicago, will be converted in its entirety to the manufacture of the company's many products. New additional equipment will be added to increase the production capacity for plasticizers, surface active agents, defoamers, which are used by the rubber, paint, paper, cosmetic. pharmaceutical, household, and chemical specialty manufacturing industries. Existing research laboratory facilities

esters. in the present building will be en-

larged to include a new laboratory for technical service applications.



Goodrich's Windbag raising roof of demountable home

the floor, including folded side and end walls, exceeds 4,500 pounds. The deflated airbag is positioned under the roof section and inflated with a conventional air compressor. In three minutes, the airbag inflates to a cell measuring 11 feet in diameter and 15 feet long, raising the roof as it inflates. With a capacity of 1,450 cubic feet. the bag requires less than one-pound pressure per square inch to accomplish this action.

With the raised roof supported by props, the hinged floor-containing folded side and end walls-rests directly against the airbag. As the bag is allowed to deflate, it takes only three minutes for these structures to be gently lowered on to their foundations. Using the airbag, the entire cycle can be performed by two men, without any of the hazards inherent in the previous method of installation and in a fraction of the 31/2 hours formerly required.

According to B. F. Goodrich, the airbag is manufactured from fabric coated with a special synthetic rubber that resists the effects of extremely high and low temperatures, petroleum products, and mildew and has exceptional resistance to abrasion. Inflated.

boat designers and manufacturers.

The Royalite construction exhibited three to five times greater impact strength than all other major boat materials. In a test demonstration in waters near the rubber company's Providence, R. I. plant, where hulls and other components are fabricated, the 14-foot runabout was run repeatedly into a floating oil drum at high speed. without damage of any kind.

Second, the material is impervious to rot, rust, worms, or corrosion. Third, it has a shock-absorbing quality which gives it a smoother ride in rough seas. and its cellular construction results in a low noise level. Fourth, it has integral color and excellent weathering properties which eliminate the need of seasonal painting. Fifth, the cellular construction gives it greater stability and a tremendous reserve buoyancy. A boat made from the material cannot sink when swamped.

U. S. Rubber does not plan to manufacture boats for the retail market. Instead it will fabricate hulls, decks, and other component parts to the exclusive designs of major boat manufacturers.

Two large-volume manufacturers-Crestliner and Wagemaker-have Roy-

Du Pont Sales Unit

A new sales development section has been established by the explosives department, E. I. du Pont de Nemours & Co, Inc., Wilmington, Del., to provide technical service to customers and develop sales for its chemical and specialty products. It will be headed by Marshall F. Acken, formerly manager of the chemical sales section. Henry H. Herring, manager of technical service and development in the chemical sales section, has been appointed assistant manager of the new organization.

The explosives department has been conducting an intensive diversification program in chemical products which include cellulose derivatives, nitrogen compounds, and polymer intermediates. The sales development section will explore markets for new products and new markets for existing products, provide technical service to customers, and direct the programs of the sales service laboratory at Carney's Point, N. J.

Herman R. Woodall, assistant manager of the chemical sales section, has been appointed manager, succeeding Dr. Acken; and William Reynolds, a product manager, has been named assistant manager.

Reelect Firestone Board

All directors of The Firestone Tire & Rubber Co., Akron. O., were reelected at the annual meeting of stockholders on January 18. These directors were: Harvey S. Firestone, Jr., Lee R. Jackson, Raymond C., Leonard K., and Roger S. Firestone, James E. Trainer, John J. Shea, Harvey H. Hollinger, and Joseph Thomas.

Following the stockholders' meeting the directorate reelected all principal officers and elected two new vice presidents:

Joseph Thomas, vice president, secretary, and general counsel; and Joseph A. Meek, vice president, production. Mr. Meek formerly was director of industrial relations.

NCGC Reorganizes

Major changes in the organizational structure of National Cylinder Gas Co.. New York, N. Y., include the formation of a separate division to supply automatic continuous processing equipment to the food, plastics, chemical, rubber, textile, and other industries. Charles J. Haines, company president, said John E. Slaughter, Jr., has been appointed president of the new Girdler process equipment division, and that Lyman L. Dawson has been named vice president.

Activities of the new Girdler process equipment division include production of Votator and Thermex equipment. Votator heat exchange equipment is used in the continuous processing of a wide variety of viscous materials in the food, chemical, and other fields. Thermex high-frequency dielectric heating equipment is used in the electronic bonding and curing of plywood, plastics, synthetic rubber, and other products.

Three other new divisions were announced: the NCG division—J. L. Adank, president: the Girdler Construc-

tion division—W. Roberts Wood, president; and the chemical products division—Walter H. Girdler, Jr., president.

The Girdler construction division will handle engineering design and construction of processing plants for the petroleum, chemical, and other industries. The chemical products division will manufacture specialty catalysts, organic pigments and flushed colors, marine detergents, and pharmaceutical intermediates.

NEWS

BRIEFS

The Timken Roller Bearing Co., Canton, O., has developed two new low-cost wheel bearings with a high capacity rating for their size. Although designed specifically for small cars similar to the European type, the new products will also fill any possible wheel bearing requirements for the same type of car that may eventually be built in this country.

United States Rubber Co., Naugatuck, Conn., has been awarded a contract by the Military Clothing & Textile Supply Agency, Philadelphia Quartermaster Depot. U. S. Army, to produce 31.680 pairs of overshoes, rubber, man's, high, black, five-buckle. The bid was \$3.94 a pair at a dollar value of \$124.819.20. The invitation for bids. QM 36-243-58-434, was opened on January 30.

Jefferson Chemical Co., Inc., Houston, Tex., recently created two product manager posts. Named to these posts were Joseph K. Goerner as manager, specialty products, and Ben C. Hayton as manager, glycol products. Goerner was formerly assistant to the general manager of the company's research and development department. Hayton since 1956 was assistant to the general manager of the company's marketing department.

U. S. Industrial Chemicals Co., division of National Distillers & Chemical Corp., has announced the new address of its Boston division sales office as 150 Causeway St., Boston 14, Mass. It will not be necessary for specially denatured and pure alcohol customers to have any existing permits changed.

The General Tire & Rubber Co., Akron, O., has reported that sales of its premium tires for automobiles during 1957 increased by 55% over 1956 sales. L. A. McQueen, sales vice president, attributed the sales gain to the growing safety desires among American motorists and the introduction of the company's twin-treaded Dual 90. General's sales curve indicates that drivers are turning more and more to the premium tire for that extra margin of safety on the road, it was said.

B. F. Goodrich Tire Co., Akron, O., has announced a \$50,000 investment in new warehousing and retread plant facilities at 1530 S. Alameda St., Los Angeles, Calif. Included in the expansion is a new 4,300-square-foot warehouse building and the installation of additional tire curing equipment in the company's present retread plant at the location. The new production equipment is expected to increase the company's tire retreading output at that plant by about 80%.

The Goodyear Tire & Rubber Co., Akron, O., has announced that all Pliofilm products now are being delivered with freight prepaid. The policy went into effect February 1. The company also announced the manufacture of a new SS-75 Pliofilm designed for wrapping of fresh or frozen meats at the self-service trade levels, where visibility, moisture, product quality, and protection are prime factors. Available for immediate shipment, the film has a yield of 30,000 square inches per pound and is being sold at \$1.10 per pound, f.o.b. Akron, with freight prepaid except in the Far West.



PIGMENTS

How to get the whiteness or color brightness you demand for your rubber products

Glidden pigments are the answer. New Zopaque Titanium Dioxide imparts greater lasting whiteness, permits brighter, cleaner tints. Finer, more uniform particles disperse much faster, more easily than ordinary pigments. Millions of tiny crystals scatter light like diamonds, assure highest opacity.

Non-fading, non-bleeding Glidden Cadmolith (cadmium-

selenium) Reds and Yellows plus new *Mercadmolith* (cadmiummercury) Reds provide everything you need to give your products maximum color appeal. They are soft, easy to grind, insoluble in all vehicles, and high in heat resistance.

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these Harflex® Polymeric Plasticizers are permanent

Harflex 300 polymeric plasticizer

non-migratory fast processing excellent dry blending good low temperature properties can be used as sole plasticizer

physical data	heat stability (180°C.)
100% Modulus	Initial Discoloration 15 min Maximum Discoloration 90 min
Elongation	extraction loss
Hardness, Shore A80 T_f 17.3°C.	Water 0.21% 1% Soap 3.45% Mineral Oil 2.10%
Flux Time45 seconds	Mineral Oil 2.10%
migration	
Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	

Harflex 325 polymeric plasticizer

economical non-migratory, permanent

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers. Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

physical data	heat stability (180°C.)
100% Modulus	Initial Discoloration15 min Maximum Discoloration90 min
Elongation	extraction loss
T _f 12.5°C.	1% Soap
Flux Time	Mineral Oil
migration	
Varnish, 25°C., 14 days	Slight staining, very slight softening Slight staining No effect

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.

The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-42R

SEBACATES PHTHALATES ADIPATES



HARCHEM DIVISION

WALLACE & TIERNAN, INC. 25 MAIN STREET, BELLEVILLE 9, NEW JERSEY 'N CANADA W C HARDESTY CO. OF CANADA LTD . TORONTO The Firestone Tire & Rubber Co.'s tire engineering and development department, has developed two new high-speed aircraft tires, capable of withstanding landing and take-off speeds up to 200 miles per hour. The tires will be original equipment on the Boeing 707—the United States' first jet airliner, which is scheduled to go into operation the latter part of 1958. Eight of the new Firestone tires, known as Sky Champions, will be used on the airliner's duel-tandem landing gear. Both tires have a new, high-speed tread design.

B. F. Goodrich Aviation Products, Akron, O., has equipped the Regulus II, Chance Vought's long-range guided missile, with tubeless tires which have been used in as many as six flights on the same missile. The landing speeds of the missile are reported to have exceeded 250 miles an hour. The tubeless tires supplied for the flights were developed following dynamometer tests which simulated the service required at speeds over 300 miles an hour.

The Pantasote Co., Passaic, N. J., manufacturer of coated fabrics, vinyl film and sheeting for draperies, upholstery, and tablecloths, has established a West Coast warehouse and sales organization at 2627 San Fernando Rd., Los Angeles, Calif. The new warehouse will stock all types and finishes of film and will be in a posit on to insure fast service for its customers in that area. Jules Pilcher has been named manager of the new sales organization and warehouse operations.

Testing Machines, Inc., a leader in manufacturing and importing of testing equipment for more than 30 years, has moved to 72 Jericho Turnpike, Mineola, Long Island, N. Y. Here in air conditioned showrooms and offices and with enlarged facilities for manufacture, repair, maintenance, and calibration, the company can offer faster and improved service to its many customers. A new department has been opened for the custom designing of new instruments and for the special modification for testing instruments that are not ordinarily handled through standard methods.

Diamond Black Leaf Products, a unit of Diamond Alkali Co., Cleveland, O., is selling its house and garden insecticides and lawn chemicals to a newly formed Illinois corporation, Black Leaf Products Co. This firm, organized by a group headed by A. K. Paul and presently establishing operations in the Chicago area, has purchased Diamond Black Leaf's house- and garden-line inventory and assets, including raw materials, formulated products, packaging and promotion materials, and the Black Leaf trade mark and trade name.

International Latex Corp., chemical division, Dover, Del., manufacturer of Tylac synthetic latex, has appointed the following three companies distributors for its latices: Technical Industries, R. I.; Latex & Rubber, Inc., Baltimore, Md.; and E. P. Lambert Co., Akron, O. Technical Industries will cover the New England area; Latex & Rubber, Inc., has been assigned the Mid-Atlantic States; and the Midwest will be covered by E. P. Lambert Co.

Pollak Industrial Corp. and Rubber Corp. of America have announced the acquisition by RCA of the entire interest of Pollak Industrial Corp. in Insular Chemical Corp., Hicksville, Long Island, N. Y. Insular, manufacturer of polyvinyl chloride resin, becomes a wholly owned subsidiary of Rubber Corp. of America.

Parker Rubber Division, Parker-Hannifin Corp., Cleveland, O., is now marketing lathe-cut synthetic rubber rectangular cross-section rings for sealing applications. These are available in all the various compounds from which Parker O-rings are molded. The new Parker process economically produces flat rings to dimensional accuracy within closer tolerances than ordinary lathe cutting, making the rings suitable for many gasket applications, it is claimed.

Wyandotte Chemicals Corp., Wyandotte. Mich., recently placed on stream the first unit for the production of methylpyrazine and 2,5-dimethylpyrazine. These new facilities complement Wyandotte's existing plant for the production of 2-methyl-piperazine and 1,4bis-(2-hydroxypropyl) - 2 - methylpiperazine (DHP-MP) at Wyandotte, Mich. The firm introduced the substituted pyrazines and piperazines to the chemical industry in February, 1955. Since that time the technology of pyrazine and piperazine chemistry and the demand for these products have grown steadily. Wyandotte's reaction to this growth has been its new production facilities and the publication of a new guide to the reactions and applications of the pyrazines.

Geigy Industrial Chemicals, Ardsley, N. Y., is adding a plastics laboratory to its facilities and showing increasing interest in stabilizers for plastics. The company is distributing experimental quantities of a new ultra-violet absorber CH3457, designed to protect plastics and other organic materials. CH3457 is reported to be a benzotriole derivative developed by Swiss researchers of the Geigy organization. It is colorless at use concentrations, cuts off radiation sharply below 3900 Angstrom units, and has noteworthy heat stability and low toxicity.

The Goodyear Tire & Rubber Co.'s tire division, Akron, O., has established district sales offices at Knoxville, Tenn., El Paso, Tex., and Billings, Mont. Growing business volume and increased customer service are the prime reasons for activating the three new field offices, said the company.

Knight Electronics, a division of Allied Radio Corp., Chicago, Ill., has introduced a new I.ne of transistor radios featuring cabinets extruded from Cycolac high impact thermoplastic resin. This reportedly is the first time a transistor radio case has ever been extruded from plastic. Cycolac is produced by Marbon Chemical, of Gary, Ind., a division of Borg-Warner Corp.

Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y., has completed a new distribution center, to serve the New England area, located on Fountain St., just west of Route 128, Framingham, Mass. It is housed in a new 6,000-square-foot building on a 20,000-square-foot site which provides plenty of room for external storage tanks and future expansion. The center, which replaces the company's former distribution center in downtown Boston, provides greater storage and filling capacity and is more conveniently located for receiving and dispatching shipments to the textile finishing plants, paper mills, and other industrial plants in New England who use Becco's hydrogen peroxide and other peroxygen chemicals. The new center will receive material in tank-car quantities from Becco's main production plant in Buffalo. Shipments from the center will be made in tank trucks, drums, or glass carboys, in the quantities more suitable to the customers' requirements.

The B. F. Goodrich Co., Akron, O., is playing an active role in America's highest priority defense program—the Air Force Ballistic Missile Program. Aviation Products, a division of The B. F. Goodrich Co., is a fabricator for the nose cone project for General Electric's missile and ordnance systems department. As prime contractor on the top priority Air Force program, the G-E department is working on the Atlas and Titan, intercontinental ballistic missiles, and the Thor intermediate ballistic missile.

William H. Rader has been made U. S. Industrial Chemical Co.'s assistant production manager for Petrothene polyethylene resins. Rader had previously performed customer service work and, as senior development engineer, had charge of polyethylene development operations at the company's Tuscola plant. U. S. I. is a division of National Distillers & Chemical Corp., New York, N. Y.

NEWS

about PEOPLE

Charles R. Ince has been elected to the board of trustees of St. Joseph Lead Co., New York, N. Y. He has been associated with the company since 1929 and a vice president of the company since 1951.

Walter D. Kramer has been named general manager of The Timken Roller Bearing Co.'s Columbus, O., plant. He replaces Leroy D. Gable, who retired February 1. Simultaneously at the Columbus plant Howard Starn was named factory manager, Fred Albright was promoted to superintendent of the railway bearing plant, and Marion J. Kowalski was made assistant chief engineer.

Raymond P. Russell has been named sales manager, B. F. Goodrich Flooring Co., Watertown, Mass. He succeeds Edward L. Farr, Jr., now marketing and distribution consultant for flooring products. During the past several months Russell was assistant sales manager, working closely with Farr. Russell has been New England district manager of B. F. Goodrich Industrial Products Co. since 1949.

Joseph Anastasio has been appointed general sales manager of consumers' products in the footwear and general products division, United States Rubber Co., New York, N. Y., and will supervise sales of footwear, clothing, sponge rubber underlays, foam rubber mattresses, golf balls, bathing caps, and other consumer products.

Joseph F. Hutchinson, manager of automotive engineering, has been named assistant to J. J. Hartz, development manager of tire divisions, The Goodyear Tire & Rubber Co., Akron, O. Succeeding Hutchinson is Willis S. Zeigler, resident engineer for the company in Detroit, Mich.

B. R. Putnam, Jr., has been named manager of the petrochemicals department of American Cyanamid Co.'s organic chemicals division. The department's major product is acrylonitrile, which is used in making synthetic fibers, rubbers, and plastics. He will headquarter in New York, N. Y.

Dan J. Forrestal has been appointed director of public relations for Monsanto Chemical Co., St. Louis. Mo. He succeeds Howard A. Marple, who will take a leave of absence for reasons of health. Later Marple will rejoin Monsanto to handle special assignments for Charles A. Thomas, company president. James E. McKee was named assistant director of public relations.

Frederick L. Kilbourne, Jr., is serving the Midwest Rubber Reclaiming Co.. East St. Louis, Ill., as technical consultant. Dr. Kilbourne was formerly connected with the Connecticut Hard Rubber Co., where he was manager of research and development. Prior to his employment with Connecticut, he was a research chemist and later chief chemist of the Xylos Rubber Co., reclaiming division of the Firestone Tire & Rubber Co., Akron, O. George N. McNamara has joined Midwest's sales department as a sales representative. He was formerly employed in this capacity for 20 years by Pequanoc Rubber Co. Howard R. Erwin has been transferred from the Paramount, Calif... plant of the Midwest company to the East St. Louis plant to assume duties as production manager. In this capacity he will be responsible for production at the East St. Louis, Paramount, and Barberton, O., plants.



Frederick L. Kilbourne, Jr.

Leland E. Spencer, vice president of the Goodyear Tire & Rubber Co.. Akron, O., has been elected executive vice president of Goodyear Tire & Rubber Co. of Canada, Ltd., Toronto, Ont. Succeeding Spencer, with the title of assistant to the president, is Mark W. Laibe, formerly director of purchases for the company. Appointed to that post is I. S. Gharky, manager of purchasing and materials at Goodyear Atomic Corp.. Portsmouth, O., since 1952.

Lewis H. Conklin has been appointed senior technical man, The B. F. Goodrich Co. development center, Avon Lake, O. He worked for two years in synthetic rubber development, and in February, 1953, became a technical man in rubber chemicals development.

Karl Arnstein, vice president in charge of engineering for Goodyear Aircraft Corp., Akron, O., who retired in 1957, has been awarded the Navy Distinguished Public Service Award for his outstanding contribution to the naval establishment in the fields of scientific research and development. He directed the construction of more than 150 nonrigid airships, including virtually all of those built for the Navy since the 1920's.

Robert M. Hill has been named manager of compounding and processing development. The Mohawk Rubber Co., Akron, O., and will be in full charge of all phases of process development in addition to his present duties that include responsibility for tire compounding. Frank M. Johnson has been named chief chemist for the Akron plant; while Ronald M. Schoonover has been transferred to the company's Helena. Ark., plant, where he will serve as manager of technical service.



George N. McNamara

Rolla H. Taylor has been appointed assistant sales manger of Scott Testers, Inc., Providence, R. I. Since 1942 he has been a member of ASTM and at present is actively participating in the work of Committees E-1, D-20, and particularly D-11. Prior to joining Scott in 1953 as sales engineer, Taylor had a broad experience in the field of elastomeric technology, including some 20 years with the National Bureau of Standards as a rubber technologist.

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A. E. Brubaker, retail advertising manager of the Firestone Tire & Rubber Co., Akron, O., has been elected chairman of the Tire Industry Advertising & Promotional Advisory Committee to the Inter-Industry Highway Safety Committee for 1958, succeeding D. E. Detwieler, passenger tire advertising and sales promotion manager, United States Rubber Co. The Tire Industry committee is made up of tire company advertising and sales promotion executives, public relations representatives of The Rubber Manufacturers Association, Inc., and the National Tire Dealers & Retreaders Association. and representatives of the tire trade press and national magazines. group meets informally with the Inter-Industry committee staff to plan industry-wide support for needed traffic safety programs.

William F. Wrightnour, widely known as a speaker and writer on management and merchandising problems, has been appointed director of management development for United States Rubber Co., New York, N. Y. Formerly operations manager for the tire division and coordinator of its management development activities. Wrightnour in his new post will work closely with the company's manufacturing divisions and service departments in establishing and applying company-wide policies and methods for the development of management personnel. He will report to the company's president, John W. Mc-Govern.

O. E. Miles has been appointed vice president, trade sales, tire division of The Goodyear Tire & Rubber Co., Akron, O. In other top-level division changes R. W. Fitzgerald, general merchandising manager, has been named sales manager, succeeding Miles; W. A. Kemmel, manager, tire departments. and J. A. Lewin, manager, dealer department, move into newly created positions as assistants to the vice president, trade sales; while C. W. Thorpe, manager, western region, has returned to Akron from Los Angeles as marketing manager, tire division. Miles fills the position vacated by Vice President Victor Holt, Jr., who recently was appointed to succeed executive vice president R. S. Wilson, now retired.



Portrait by Roberts

Rolla H. Taylor



George C. Schweiker

George C. Schweiker has been appointed to the new position of manager of research as part of a general expansion in research and product development. Velsicol Chemical Corp.. Chicago, Ill. Dr. Schweiker will be responsible for the basic research programs of the Velsicol research and development department. These will encompass areas of agricultural and industrial chemicals, polymers, organic processes, and other new fields of interest.

E. A. Custer has been appointed assistant manager of sales for the American Zinc Sales Co., distributor for the American Zinc, Lead & Smelting Co. He joined the sales department of the sales company in New York, N. Y. in 1948. In his new capacity he will continue at the general offices of the company in St. Louis, Mo.

Kenneth H. Klipstein and George R. Martin, vice presidents, have been elected to the newly created office of executive vice president of American Cyanamid Co., New York, N. Y. Klipstein, who joined Cyanamid in 1933, became a vice president and director in 1957. He has served as assistant general manager of the former Calco division and as general manager of the research division. Martin joined Cyanamid in 1927 to organize a legal department and served as its head until 1951. He has been a member of the board of directors since 1928 and a vice president for 13 years.

Clifford J. Backstrand has been elected a director of Pittsburgh Plate Glass Co., Pittsburgh, Pa., to succeed Richard B. Tucker, resigned. Tucker has been associated with the glass industry for more than 50 years. His association with Pittsburgh Plate Glass Co. began in 1929 and he served as a director since 1942. He retired as a vice president at the end of 1956. Backstrand has been president of Armstrong Cork Co. since 1950 and a director of that company since 1935.

Edgar I. Crowley and John R. Weinert have joined the research and development department of Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Crowley goes to the department's engineering development section as a senior chemical engineer; while Weinert will be a senior chemist in the research and development laboratory's protective coatings section.

Edward Wichers now is associate director for chemistry at the National Bureau of Standards, Washington, D. C. He succeeds Wallace R. Brode, who recently was granted a leave of absence to serve as science advisor to the Secretary of State. Dr. Wichers has served the Bureau in several responsible positions for some 40 years. Since 1948 he has been chief of the chemistry division, where under his direction the scope of research activities has been significantly enlarged. Especially notable was his creation of a new facility devoted to research on extremely pure substances - research which is basic to the determination of the fundamental properties of matter.

Richard L. Halstead has been assigned to the position of manager, continuous molding sales; and C. A. Matz to the position of manager, tire and farm equipment sales. The Ohio Rubber Co., Willoughby, O., a division of Eagle-Picher Co. Halstead has been with the company for four years, having started as a development engineer. He was product manager until the time of his promotion. Matz was formerly supervisor of tire and track engineering.

E. Leonard Borg has been named manager of synthetic rubber development for Naugatuck Chemical Division, United States Rubber Co., New York, N. Y. Borg, formerly assistant manager of synthetic rubber development joined Naugatuck Chemical at Naugatuck, Conn., in 1942. He was a member of a three-man team that developed, under a government-sponsored program, the cold latex formulation now in industrywide use for the production of foam rubber. He also contributed to development work on new polymerization techniques for oil-resistant and other specialty-grade synthetic rubbers.

Jonathan B. Stovall, Jr., has been made chief shoe technician for Wellco-Ro-Search, Waynesville, N. C. He was formerly in charge of the shoe manufacturing operations of Carolina Maid Products, Inc., before joining Wellco-Ro-Search.



J. T. Doyle

J. T. Doyle has been named manager of the Andrews-Alderfer division of The Kendall Co., Akron, O., which manufactures foam fabric products for the apparel, automotive, floor covering, medical, shoes and footwear, and specialties industries. He replaces R. M. Hoey general manager of the division since Kendall purchased this operation in December, 1955. Hoey has been reassigned as works manager of the Chicago division of The Kendall Co. and will have responsibility for the operating management of the Chicago division plants in Chicago; Rockford, Ill.; South Bend, Ind.; Franklin, Ky.; Toronto, Ont., Canada; Mexico D. F., Mexico; and Akron.

James C. Hance has been appointed manager, market research, of Jefferson Chemical Co.'s commercial development division, Houston, Tex. Harold B. Lawson has been named controller of United Carbon Co., Charleston, W. Va. He formerly was treasurer of The Dobeckmun Co. and earlier had been controller of the Firestone Industrial Products division of Firestone Tire & Rubber Co.

Robert R. Johnson has been elected vice president-engineering; E. Burke Neff, vice president-quality and cost control; Loren J. Sewall, vice president manufacturing; and Richard G. Wells, vice president and director of sales of the Minnesota Rubber Co., Minneapolis, Minn. The promotions followed a recent corporate reorganization in which the firm's four subsidiaries were integrated in the parent company and given divisional status.

Thomas G. Gibian has been named general manager of the organic chemicals division, Dewey & Almy Chemical Co., division of W. R. Grace & Co., Cambridge, Mass. Gibian succeeds Russell L. Haden, who has joined Virginia-Carolina Chemical Corp. Gibian will also continue his responsibilities as general manager of the firm's battery separator division.

L. Laurence Forward, Nathaniel B. Nichols, Marc E. Porter, William M. Walters, Karl H. Hubbard, and Frank S. Ward were named vice presidents at a recent directors' meeting of Taylor Instrument Cos., Rochester, N. Y. Forward is vice president and general sales manager. Nichols becomes vice president and chief engineer. Porter. a director and a member of the executive committee, is also treasurer of Taylor. Walters, also a director and member of the executive committee, will continue as head of all Taylor manufacturing. Hubbard becomes a vice president with responsibility in the area of research. Ward, a member of the board and of the executive committee, becomes vice president and administrative assistant to the president, Raymond E. Olson.

Edwin J. Delaney has been named to the newly created position of assistant general manager of The Goodyear International Corp., Akron, O. Delaney had been vice president and managing director of Goodyear-Argentina since 1953.

Dean Daniels has become western district sales manager for the silicone products department, General Electric Co., Waterford, N. Y. Stationed at the district sales office in Downey, Calif., he succeeds Robert T. Daily, now manager-rubber market development for the department, who will direct market research, sales planning, and technical service for the department's silicone rubber product line.



Harold B. Lawson



Thomas G. Gibian



Edwin J. Delaney

Karl L. Rohde, Jr., has been made sales representative for organic chemicals, Dewey & Almy Chemical Co. division of W. R. Grace & Co., Cambridge, Mass. For the next few months he will assist the headquarters staff and national field sales force, expediting special programs for the sales of the firm's vinyl acetate polymers and copolymers, butadiene styrene latices and resins, plasticizers, and dispersing agents.

James J. Lowe and Charles A. Chabot have been elected vice presidents, Peters Mfg. Co., Wollaston, Mass. Lowe, formerly sales manager of American Mfg. Co., will be in charge of marketing; while Chabot, previously associated with American Steel & Wire Co., will head up the research and development division of the firm, which makes tapes, coated papers, films, and fabrics.



Robert W. James

Robert W. James has been appointed to the sales staff of Chemical Rubber Products Inc., Beacon, N. Y., and will be responsible for the sale of the firm's elastomer-coated fabrics in the eastern area.

Donald K. Slade has joined the Polyco-Monomer department of the Borden Chemical Co. as a process engineer. He will specialize in process and project work on polyvinyl alcohols at the company's plant in Leominster, Mass.

John K. Moffett, Jr., of U. S. Industrial Chemicals Co., division of National Distillers & Chemical Corp., New York, N. Y., has been appointed assistant manager of Petrothene^R polyethylene sales. He was previously in a sales development position for the company's polyethylene resins.

Frank A. Cobb has been appointed manager of the Detroit tire plant, United States Rubber Co., Detroit, Mich. Mr. Cobb, formerly manager of the Eau Claire, Wis., plant, succeeds Harold E. Weigold, now assistant to the division's production manager. Weigold will work on technical and processing problems for the company's five tire plants. He will maintain his headquarters at Detroit. Succeeding Cobb as Eau Claire plant manager will be Robert G. Francis, formerly assistant factory manager.

C. R. Chester, formerly assistant sales manager of the Atlantic India Rubber Works, Inc., has become associated with the Ace Hose & Rubber Co., Chicago, Ill., as special assistant to the president, Eugene Behrstock. Chester's new duties will encompass management of the sales and engineering departments, as well as administrative supervision. He comes to Ace after 30 years on molded, extruded, and lathe-cut rubber products, in which fields he is considered an authority.

Malcolm R. Tucker, newly appointed fatty acid sales representative for Cincinnati territory for Emery Industries, Inc., Cincinnati, O., is a ten-year veteran of the company and will operate in a territory which includes most of Ohio, West Virginia, eastern Indiana and Kentucky, and southwestern Michigan.

W. E. Ecclestone has been appointed manager of marketing, a newly created position at the Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont. Donald S. Hewitt, assistant manager of the firm's London, Ont., branch, has been appointed acting manager, central Ontario division, with head-quarters in Toronto. He succeeds W. E. Ecclestone. W. M. Ecclestone has been named assistant manager of the central Ontario division. He was formerly manager of the southern region of the division.

Howard H. Deem has been appointed director of manufacturing for both Valvair Corp. and Sinclair-Collins Valve Co. He will direct manufacturing and foundry operations in Valvair's Akron, O., and Canton, Pa., plants.

Edward H. Winkleman has been named eastern regional sales manager of Pittsburgh Coke & Chemical Co.'s industrial chemicals division. He will be in charge of the company's industrial chemical sales in New England, New York, New Jersey, eastern Pennsylvania, Virginia, Delaware, and Maryland. He will headquarter at the company's regional sales office, 485 Lexington Ave., New York, N. Y.



Frank A. Cobb



Malcolm R. Tucker



Howard H. Deem

News about People

Geoffrey G. Beard, president of United Engineering & Foundry Co., Pittsburgh, Pa., has announced the election to the board of directors of Charles F. Safreed, president of McNeil Machine & Engineering Co., Akron, O., to fill a vacancy created by the retirement of C. T. Zinsmeister.

Charles H. Stockman has been named manager, research operating, at The B. F. Goodrich Co.'s research center. Brecksville, O. Dr. Stockman joined the research center staff in 1950 as a chemical engineer. He was on loan to the Atomic Energy Commission and served at the Argonne National Laboratories from September, 1953, until September, 1954.

H. K. Eckert, having been appointed assistant general manager of Monsanto Chemical Co.'s plastic division, will be responsible for coordinating the overall administration of the Texas City, Tex.. location, which includes units of the division's research and engineering departments in addition to manufacturing facilities.

Willard H. Madson has been named manager of the trade sales paint section, technical service laboratory, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. George Wormald has been made manager of the industrial and automotive finishes section: Harold C. Brill, manager of the paper, ink. and fibers section: and Robert H. Zabel, manager of the plastics and elastomers section.

Carter L. Burgess, formerly president of Trans World Airlines, has been elected president of American Machine & Foundry Co., New York, N. Y., according to Morehead Patterson, chairman of the board and chief executive officer. From 1954 to 1956 Burgess served as Assistant Secretary of Defense for Manpower and Personnel. From 1947 to 1953 he had been assistant to the president and director of administration of the General Aniline & Film Corp.

Iver G. Freeman, known throughout industry for his development work on plastics injection machinery, has been named vice president in charge of research and development programs for the Reed-Prentice division of Package Machinery Co., New York, N. Y. J. Joseph Kelly has been elected vice president in charge of the division's sales; while Edward W. Forth becomes vice president in charge of machine tool activities. The three vice presidents were elected from the recently incorporated Reed-Prentice division of the company, which is expected to provide major contributions in the development of new machinery for the tire and rubber industry.

Mario DiFederico, Akron factory manager of Firestone Steel Products Co., has been appointed vice president in charge of sales. New Akron factory manager is Robert J. Loeven, former plant superintendent.

John W. Groesbeck has been appointed a salesman of industrial fabrics and yarns to the mechanical rubber goods industry for Callaway Mills, Inc., New York, N. Y. He will have his headquarters in the New York office.

Charles H. Rybolt has been appointed director—chemical divisions, Wallace & Tiernan Inc., Belleville, N. J. He will retain his present position as general manager of the Lucidol division at Buffalo, N. Y. Wallace & Tiernan's Lucidol division manufactures organic peroxides used as polymerization catalysts for vinyl and polyester plastic resins.

Robert A. Barker has been appointed manager of engineering, and Fred Wetzel has been named engineering consultant for the wire and cable division. The Electric Auto-Lite Co., Toledo, O. In his new post Barker will direct the activities at the wire and cable research laboratory at Port Huron as well as advancement of present product engineering and production methods and expansion of the divison's product lines.

Coleman S. Bost has joined the synthetic industrial fabrics department, J. P. Stevens & Co., Inc., New York, N. Y., and will concentrate on technical service to customers and will work out of the New York office. He will be concerned with the sales of all synthetic fibers, with the exception of fiber glass.

J. Lawrence Pond has been appointed treasurer of The Seamless Rubber Co., New Haven, Conn. At the same time, Edward C. Crotty was named secretary and assistant treasurer of the company. Crotty moves up from the position of assistant secretary and assistant treasurer, which he held since 1954. He joined Seamless in 1948 and is president-elect of the New Haven Association of Credit Managers. Pond, with Seamless since 1942 and vice president in charge of purchasing since 1945. succeeds Edward J. McDonald, who is retiring July 1, after 48 years with the company.

J. R. Brandon has been appointed manager of the newly organized field service department, industrial products division of Hewitt-Robins, Inc., Stamford, Conn.; while J. H. Hayden, Jr., has been made product manager of conveyor equipment sales, Robins Conveyors Division, Passaic, N. J.

Ralph E. Harrington has been made merchandising manager in a realignment of capacities in The General Tire & Rubber Co.'s advertising, sales promotion, and merchandising departments, Akron. O. John G. Ragsdale will now handle the overall advertising and sales promotion operations.

Matthew S. McCauley, director of business research for Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo., has been appointed director of marketing research for the division and now is responsibile for continuing study of general marketing conditions as they apply to the varied products of the division, for analyses of market characteristics and trends for specific products, and for the evaluation of market potentials as a basis of product sales plans and forecasts.

Joseph H. Ward, named a sales representative in Pittsburgh Coke & Chemical Co.'s industrial chemical division, will handle sales of the company's industrial chemicals in the New York territory of Brooklyn, Long Island, and upper New York State.

Clement H. Watson, general manager of the Atlantic Gelatin division. General Foods Corp., has been elected a director of the Alco Oil & Chemical Corp., Philadelphia, Pa.

Obituary

Henri Chauvin

Henri Chauvin passed away at his country home on December 29, 1957. He was born in Ottawa, Ont., November 4. 1902, and was a graduate of College Ste. Marie, and in 1924, of the University of Montreal in Engineering.

He joined Dominion Rubber Co., Ltd., in 1928 as development engineer at the Papineau factory in Montreal and in the St. Jerome footwear plant. Then he was chief chemist at the British Rubber Co., Ltd.'s. footwear factory in Lachine from 1937 to 1940; chief chemist at Acton Rubber, Ltd., Actonvale, P.Q., from 1940 to 1942; and again chief chemist at Miner Rubber Co., Ltd., Granby, P.Q., until 1950. He then rejoined Dominion Rubber's mechanical development department as compounding supervisor in the development and quality control laboratory.

Chauvin was a charter member of the Quebec Rubber & Plastics Group and a past director of the Group. He was also a member of the American Chemical Society and its Division of Rubber Chemistry.

He is survived by his widow and one son.

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A hose that takes extremes of heat and cold without cracking; attachable tire side-wall rings in white and a variety of colors for extra beauty in today's cars; and boots with superior resistance to weather and wear , . . all through the use of Enjay Butyl.

Enjay Butyl—today's colorful rubber

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NEWS

from ABROAD

Russian output of synthetic rubber is expected to reach 800,000-850,000 tons

We may add a recent report, credited to Tass, the Soviet News Agency, according to which the first Soviet Russian plant for producing synthetic rubber based on natural gas was opened September 25, 1957, at Sumgait, near the Baku oil center.

USSR

Polymer Research

Kunstoffe1 recently presented some information on high polymer research in Leningrad and Moscow, as reported by a Polish woman scientist, Prof. E. Turska, on her return from a study of research centers in Western Europe and the USSR.

Fundamental research on high polymers in Russia is conducted chiefly in two institutes, the Institute for Macromolecular Compounds, Leningrad, and the Institute for Element-Organic Compounds, Moscow.

The Leningrad Institute, until recently directed by the late Prof. P. P. Kobeko, is now under the direction of the corresponding member of the Academy of Sciences, Prof. S. N. Danilov, and comprises eight research laboratories:

(1) The chemical laboratory for cellulose research.

(2) The chemical laboratory for research on (a) radical initiation of polymerization; (b) the mechanism of inhibition; reaction mechanisms of polymerization, cross-linking degradation, under the influence of reversible redox systems.

(3) A special laboratory for investigating the polymerization of vinyl compounds, which has a separate division for epoxy resins.

(4) A laboratory for investigation of polycondensation processes, particularly the relation between structure and macrophysical properties of polycondensates.

(5) The physical-chemical laboratory devoted to studying (a) kinetics of elementary processes in polymerization. cross-linking and degradation, in which use is made of tagged atoms, also ultracentrifuges; (b) mechanism of ion exchangers.

(6) A physical-chemical laboratory for solutions of high polymers; all workers here have special mathematical

(7) The laboratory for structural research of high polymers, which has a separate section for infra-red spectroscopy; physicists and mathematicians

mainly are engaged on the important theoretical work done in the wellequipped laboratory which disposes over four infrared spectrographs, two automatic recording devices for Raman spectra, spectral photometers, X-ray apparatus, etc.

(8) The laboratory for electrical measurements, where mechanical properties of polymers are studied.

The Institute for Element-Organic Compounds is under the direction of Prof. A. N. Nesmejanov. Its scope is much wider than that of the Leningrad Institute. A section of the center is devoted to the chemistry and physical chemistry of high polymers and is under Prof. V. V. Korsak, corresponding member of the Academy of Sciences. This section includes three separate divisions devoted, respectively, to (a) polycondensation (processes in polyamides and polyesters); the significance of the degradation processes and of equilibria in the polycondensation processes receives special attention, since Korsak's opinion here is opposed to that of Flory (in the U. S. A.); (b) polymers with a carbon chain, and (c) physical chemical studies. A laboratory for the analysis of X-ray structures and optical and analytical laboratories collaborate with these divisions.

Professor Turska emphasizes that the USSR strives to relate fundamental research to practical applications. Both the Institutes named above aim at coordinated group work to solve the larger theoretical problems, and both appoint teams of different specialists to work on a definite problem; a high educational background is required of all investigators.

Synthetic Plants

In connection with the above, attention may be called to a note in Plaste und Kautschuk2 according to which a Russian source states that there are now synthetic rubber factories in 17 different places within the Soviet Union, as follows: Moscow, Leningrad, Jaroslawl, Woronesch, Jefremow (Tula), Baku, Jerewan (Armenia), Aktubinsk (Kazakstan), Magnitogorsk, Kazan, Nowo-Tagil (Ural), Kemerow, Riga, Mitschurinsk, Medweschinsk, Risch-kowo, and Temir-Tau (Karaganda).

Plastics Courses

During October 15-November 1957, a delegation of five, consisting of the principal and three heads of departments of the College of Technology. Birmingham, and an interpreter, visited Russia at the invitation of the Russian Ministry of Higher Education, to see Russian methods of Education. In a recent issue of British Plastics3 G. Tolley, head of the Department of Chemistry at the Birmingham College of Technology, detailed some aspects of plastics education in Russia, from which the following information and impressions are gathered.

There is a marked tendency to encourage students to spend one or two years in industry after they have finished school and before they go to the universities; 60% of all students entering the universities and colleges in any year must have had industrial experience, and apparently only the best students go directly from the schools to the higher institutes.

Universities are responsible for pure science and the humanities, and technological work is done in polytechnics or specialized institutes; many of the latter are large and have impressive traditions of achievement. There are, in addition, a number of specialized craft-level institutions.

Three centers of plastics education were visited: Mendeleev Institute of Chemical Technology, Moscow, Department of Prof. G. Petrov; Institute of Chemical Engineering, Moscow, Department of Prof. A. N. Levin; Institute of Chemical Technology, Dnepropetrovsk, Department of Prof. I. V. Machinskaya.

While a few lacks were noted on the technological side at Mendeleev, research work in the technical laboratories was found to be of a very high quality, and the author would classify a graduate of this institute as a plastics chemist with very good knowledge of the chemistry of plastics and a working knowledge of processes. At Dnepropetrovsk the emphasis at present is mainly on chemistry, but there are plans for considerable expansion involving several new laboratories, also for technological work. At the Institute of Chemical Engineering, Moscow, the emphasis is mainly on design. The author considers the laboratory not so well equipped as his own. But diploma and post-graduate work at the technological

¹ Sept., 1957, p. 545. ² Nov., 1957, p. 405. ³ Dec., 1957, p. 545.

laboratories are again of very high standard; the author was particularly impressed by the enthusiasm of staff and students, and the high quality of plastics engineers produced.

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The three institutes together produce 175 qualified plastics technologists annually, of whom 50 are engineers. A number stay on at the institute to continue post-graduate work; others join the Research Institute of the Ministry of Chemical Industry, or other ministries. From 40-60% of the students in the plastics, rubber, and paint fields are girls.

The delegation also visited the Karpov Institute of Physical Chemistry for Industry, in Moscow, which has a staff of 700, including 200 qualified scientific workers engaged in work on high polymers, electro-chemistry, and the kinetics of inorganic reactions, studies on the initiation of polymerization by ionizing radiations; electron diffraction studies of isotactic materials; mechanical properties of polymers, Ziegler catalysts.

An important conclusion drawn from the visit was the vitally important position held by the technological institutes in Russia.

"Industry looks to these institutes constantly for advice and cooperation," Mr. Tolley said. "There is extremely close contact between staff in industry and academic staff, and each institution has a number of factories allotted to it for the purpose of arranging the industrial training of students. There is no fear of shortage of academic staff in Russia because salaries are graded to insure that this will not happen, and as a consequence, men of considerable industrial experience find their way as professors and as senior lecturers into technological institutions."

Finally the very efficient information and abstracting services are remarked, which are available in Russia.

Malaya Rubber Exports Up

More than a million tons of rubber were exported by Malaya during 1957, official statistics indicate. At 1,002,237 tons, the total was the highest since 1951 and topped the million-ton mark for the first time since that year. The amount included 10.7% of latex and 58.7% of ribbed smoked sheet.

The 12-month figures brought out more sharply the spectacular rise in Japan's purchases of rubber from Malaya, noted earlier in 1957; by the end of the year the total was 108,471 tons, 45½% more than in 1956, Japan's imports of rubber have been gaining steadily since the end of World War II, reflecting both the rehabilitation and the steady expansion of her postwar rubber industry, especially marked

since 1951. The greatest increase in imports from Malaya took place in 1957, and the figures for that year represent a rise of 71.8%, as compared with 1951 figures. Japan now ranks as Malaya's third best customer for rubber.

The figures released so far for Malaya's rubber exports in 1957, show increased purchases also by Argentina. China, Soviet Russia. Poland, and Spain, among others, but declines for the United Kingdom, the United States. West Germany, France, Italy, Canada and Australia. It is to be noted that while Soviet Russia buys most of her rubber on the London market, her direct imports from Malaya increased 17% last year. The following table gives the distribution among most of the leading importing countries, and the changes, in %, as compared with 1956:

	%
Tonnage, 1957	Change from 1956
205,627	- 11.5
147.845	- 4.7
108,471	+ 45.2
69,650	- 14.7
	- 9
	- 8.8
	- 8.6
31,543	+ 55.9
31.367	+260
	- 7
	+ 19.5
	+ 25
14,982	+ 17
	1957 205,627 147,845 108,471 69,650 65,351 51,063 31,543 31,367 28,342 22,139 21,850

Rubber Imports, Output

Imports of crude rubber into Malaya in 1957 dropped to 363,271 tons, from 365,824 tons the year before. Of these amounts, Indonesia sent 301,949 tons during 1957 and 303,436 tons during 1956.

Combined production of natural rubber by Malayan estates and small-holders totaled 638,713 tons in 1957, 1.7% above 1956 output. Estates over 100 acres increased their output by 4.7% to 369,777 tons, but this rise was offset by lower production by smallholders, who accounted for 268, 936 tons, 1.9% less than in 1956. The smallholders evidently slowed down their tapping as a result of the drop which took place in the price of rubber.

Rubber Goods Imports

Britain increased her shipments of rubber manufactures to Malaya by 19% last year, supplying two-thirds of Malaya's total imports of these goods. Competition for the Malayan market by Japan and Germany, therefore, does not appear to have affected Britain's position in the Malayan market to any considerable degree, although their efforts have been suc-

cessful in a few fields. Thus Japan has become the leading supplier of inner tubes for bicycles, sending 622,224 units in the first 10 months of the year, to Britain's 557,500 units; and West Germany sent 112 tons of fabricated rubber sheet, against 20 tons by Britain. But Britain still supplies most of the other items imported, including (in the 10-month period) 118,543 automobile tires, 66,297 truck and bus tires, 17,382 motorcycle and 731,722 cycle tires, in addition to belting, conveyors, floor tiles, and medical and surgical rubber goods.

Malaya reexports about one-third of the imports to neighboring countries; Celebes and Moluccas took most of the car tires; Siam, truck, bus, and bicycle tires; and Hong Kong, motorcycle tires.

Wage Talks

Once again the question of a basic wage for rubber plantation workers instead of the present sliding-scale system of pay fixed for a quarter on the basis of the average price for rubber in the preceding quarter will be discussed by the National Union of Plantation Workers and the employers' association, the MPIEA. At a preliminary meeting at the end of January, the Union submitted its new wage demands. Few details of the proposals put forward have been published except that the Union has asked for a minimum wage independent of the rubber price, incentive bonuses for increased production, and annual bonuses for all workers.

Reports current in the beginning of January stated that the Union had asked for a basic wage of \$3.50 a day (Straits currency) for tappers, and that it wanted the existing wage agreement cancelled when it expired at the end of March. According to details in the Straits Times of January 21, however, the Union proposed a basic wage of \$2.80 when the price of rubber is between 65 cents and \$1.10 a pound; if the price goes over \$1.10, the workers would want to negotiate for higher wages, while if it went below 65 cents, employers could negotiate for a reduction in wages. The Union also wants a standard cost-of-living allowance for all estate workers and a yearly bonus, besides specified sick benefits and leave and dismissal benefits. The Union is said to have declared its readiness to cooperate with employers in efforts to increase production, but with the proviso that workers be assured a reasonable standard of living.

According to a recent report, the National Union of Plantation Workers, representing more than 300,000 rubber estate laborers, is to merge with the All Malaya Estate Staff Workers' Union, which has a membership of 5,000 white collar workers.

NEW

EQUIPMENT

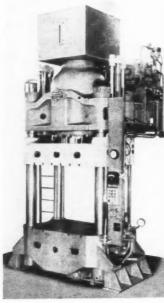
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has designed and built a selfcontained oil hydraulic molding press capable of curing for cycles lengths up to 45 minutes. This 1,650-ton press is to be used by the medium voltage switchgear de-partment of General

Electric Co., Philadel-

phia, Pa., for molding special electrical equipment products.

19 feet above the floor.

Improved Molding Press



Birdsboro 1,650-ton molding press

The new four-column vertical press has a 34inch stroke and can mold a wide range of raw materials including plastic. rubber, ceramic, and allied products. The platen area is 62 inches left to right, 62 inches front to back, with a daylight dimension of 4 feet 8 inches. Overall height is

A double-pump design, a large power pump combined with a small holding pump, saves horsepower and lowers the amount of heat induced into the oil hydraulic system.

On an extended pressing cycle, oil from the main pump is automatically bypassed, and the small holding pump maintains pressure for the remainder of the cycle. This system allows the use

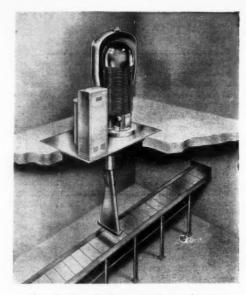
of smaller heat exchangers to cool the oil.

Variable control of pressing speed assures uniform density of the finished product. Tonnage can be lowered from the maximum 1.650 tons directly from the control panel. Pressing and curing cycles are completely automatic or can be push-button controlled as required. The bottom ejector cylinder is manually operated by direct-control hand-lever to permit proper sensing of stripping speed by the operator.

New Van de Graaff Machine

A new-model Van de Graaff particle or electrostatic accelerator recently announced by High Voltage Engineering Corp., Burlington, Mass., will enable in-line radiation processing in certain industrial applications where, until now, it has been economically impractical. Visitors to HVEC's booths 188-189 at the Trade Fair of the Atomic Industry, which opened October 28 at the New York Coliseum, learned firsthand from company engineers details of the new machine.

The Model GS, a 1.5-million-volt machine, will produce ionizing radiation for under \$20,000 per kilowatt and is the most inexpensive particle accelerator presently available for in-line processing use, it is claimed. Development of this new radiation source was aimed specifically at extending the practical range of Van de Graaff particle accelerators in industrial treat-



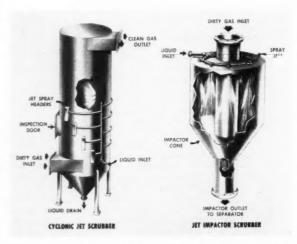
Van de Graaff electrostatic accelerator

ment of films. sheets, wire, liquids, gases, and powders—areas where radiation cost per kilowatt has heretofore been prohibitive. Van de Graaff machines have long been used as radiation sources in development of cross-linking, sterilization, catalysis, polymerization, vulcanization, and other techniques.

The new machine is compactly designed. The electron beam is scanned through a thin aluminum window 66 inches below the unit's base plate, making installation possible in minimum space. DC in nature, the ionizing radiation can be accurately controlled and monitored.

New Gas Scrubbing Systems

Recently developed and manufactured by the process equipment division of Automotive Rubber Co., Inc., Detroit, Mich., are the new ARco jet (wet type) gas scrubbing systems for the metal, chemical, electroplating, and allied industries. These new scrubbers are available in two types of designs. The cyclonic jet type handles dust and liquid aerosols which are micron in size or larger-particles developed from mechanical processes by disintegration. The jet impactor type (agglomerator) handles fumes, fogs, mists which are submicron in size-particles developed from chemical or metallurgical operation where a change of physical state occurs. Standard ARco jet scrubber sizes range from 500 to 20,000 cfm. capacity.



ARco cyclonic jet scrubber and jet impactor scrubber

18

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ANNOUNCING PHILPRENE* 1805

...a great <u>new</u> polymer born of Phillips Research

Phillips Chemical Company, leader in synthetic rubber research, has created a new and distinctive polymer, PHILPRENE 1805. This new rubber fills the need for a *low cost* pigmented rubber with many valuable qualities usually associated only with higher priced polymers.

Philprene 1805 is the result of many thousands of hours of testing and evaluation, plus a greatly improved manufacturing process. High tensile strength, excellent flex life, and resistance to wear and tear make this new polymer a boon to manufacturers of high grade mechanical and industrial rubber products. Philprene 1805 is already taking an important place in the manufacture of camelback.

Introduced experimentally as Philprene 6600, this new rubber is now available commercially. It has been permanently designated Philprene 1805, according to standard ASTM procedure.

Two other new pigmented polymers, made by the same improved process, are now in the experimental stage. Temporarily designated as Philprene 6601 and Philprene 6610, they are designed primarily for tire tread service.

For more information, write for the Philprene brochure or consult your Phillips technical representative.

*A Trademark for Phillips high quality synthetic rubber.

**A Trademark

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non-staining, pigmented, oil-extended cold rubber polymer which contains 75 parts of Philblack** O, a High Abrasion Furnace (HAF) carbon black, and 37.5 parts of a naphthenic type oil.

PHILPRENE 1805 is a

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SPADONE TRUCKS are available in Standard and Special Models or furnished to your individual specifications. Write for detailed information. Our Engineering staff will be pleased to help with your requirements.



New Equipment

Typical applications for the scrubbers used in industry are: rotary or lime shaft kilns, asphalt plant driers, superphosphate manufacturers, incinerator plants, etc. The jet impactor model is typically used in the metallurgical operations such as non-ferrous; reverberatory and blast furnaces, etc., ferrous; blast furnaces, cupolas. It is also typically used in chemical operations such as: sulphuric acid mists, phosphoric acid mists, MEA dry ice plants.

Both types of units are operated on water or other recycle solutions piped into spray jet headers located on the main body of the scrubber.

For more and complete information on the wet-type gas scrubbing systems send for Bulletin 957 available from the company.



Turner Uni-Drive transmission

Turner Offers New Transmissions

Turner Uni-Drive, Kansas City, Mo., is offering new Models 240 and 540 transmissions, with selective gears in four, six, and nine ranges of speed. Standard high to low output ratios vary from 4.7/1 to 8/1, with maximum 12.4/1 step-down; a step-up ratio of 1/8 is possible in certain applications. Compact space envelopes of 17 by 19 by 7 inches for Model 240, and 20½ by 20 by 7½ inches for Model 540 gear boxes, permit use in a variety of installations. Durability is assured with close-grained grey iron housing, 20-degree stub-tooth gears, and tapered roller bearings tested for overhung loads.

The built-in advantages of standard multi-speed transmissions are effecting great savings in applications on road machinery, oil or water pumping rigs, conveyors, testing machines, textile frames, rolling mills, wire drawing spindles, oil core-drills, and paper-making rolls. Primarily, selective gear transmissions permit electric motors or gas engines to operate at their most efficient speeds, with no overload conditions. Numerous additional advantages include elimination of constant changing of V-belt sheaves; instant selective speed control to adjust to installation needs; cost reduction by use of smaller high-speed electric motors; belt-drive smoothness with greater bearing service due to offset shafts; resistance to effects of high starting torques, shocks, and reversals.

Standard models are available with proven load capacity, output ratios, and variety of speed ranges.

"Femco Service News." The Falls Engineering & Machine Co., Cuyahoga Falls, O. 4 pages. This informative and photographically illustrated news sheet is the first issue of a series which will be published every three months. The issue presents articles on the company's trimmers, cutters, splitters, and related machinery used in the rubber industry as well as information on the company's new developments and personnel.

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Gives a flash-free finish in far less time, at far less cost. On plastic as well as rubber components and parts. CO₂ tumbling is the efficient, automatic way to remove flashing and rind. Ends expensive hand trimming—frees labor for more important work.

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CO2 and Liquid Carbonic know-how are doing a remarkable job in foam rubber and plastics, too. As the world's largest producer, we are ready to supply CO2 at any pressure desired for the foaming of thermoplastics.





Forming Foam?

The market for foam rubber is growing rapidly. An efficient mold release agent helps you get maximum output of high quality products. That is why you should consider Ucox rubber lubricants as mold release agents.

Ucon rubber lubricants have been proved outstanding by years of extensive use. They are easily applied and give clean, quick release. And, Ucox rubber lubricants usually reduce or eliminate mold cleaning problems frequently encountered in foam rubber production. Ucox rubber lubricants are available in both water-alcohol soluble and gasoline soluble series-they can also be emulsified.

Ucox rubber lubricants can help you make a better foam rubber product. Write for samples and further information . . . address Department B.

UNION CARBIDE CHEMICALS COMPANY

DIVISION OF UNION CORPORATION



30 East 42nd Street, New York 17, New York

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NEW

MATERIALS

New Silicone Rubbers

Availability of a new series of silicone rubbers with much greater resistance to compression set at high temperatures has been announced by Dow Corning Corp., Midland, Mich. Developed to meet the need of more reliable oil seals and gasketing materials in automotive, appliance, and aircraft applications, these new rubber stocks are also recommended for many other military and industrial sealing and gasketing applications involving extra-high temperatures and high or constant pressures.

The new rubbers are also satisfactory for O-rings and similar parts in food, drug, and cosmetic processing equipment, it is further claimed. Currently, three different stocks in the new series are being produced in pilot-plant quantities. Identified as Silastic S-2096U, S-2097U, and S-2098U, they produce 60, 70, and 80 durometer, Shore A, hardness, respectively. All three have a serviceable temperature range from -70 to 500° F. Some typical properties of the three compounds follow:

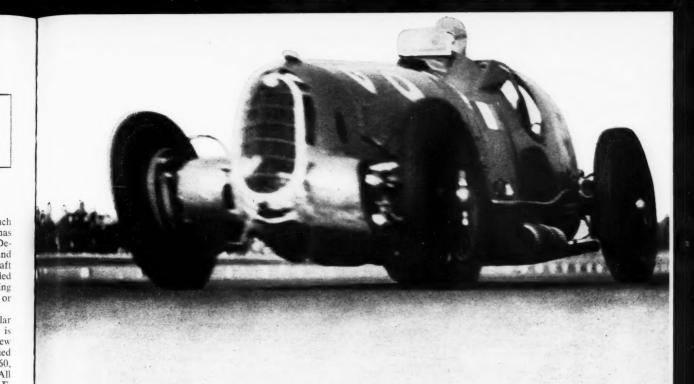
Silastic S-2096U

Property	Vulcanized with Silastic S-2084	Vulcanized with 2,4-Dichloro- Benzoyl Peroxide
Color	red	red
Specific gravity, 77° F	1.23	1.23
D 676-55	60	55
Tensile strength, psi., ASTM D 412-		
51 T	600	720
Elongation, %, ASTM D 412-51T	110	150
Tear strength, lbs./in., ASTM D 624-		
54 Die B	30	35
Brittle point, °F., ASTM D 746-55T.	-100	-100
Compression set, after 70 hrs. @ 300°		
F., %	. 7	11
22 hrs. @ 480° F., %	45	70
Shrink, %, during molding	2.7	2.0
And curing	3.7	2.9

Silastic S-2097U

are

Property	Vulcanized with Silastic S-2084	Vulcanized with 2,4-Dichloro- Benzoyl Peroxide
Color	red	red
Specific gravity, 77° F	1.29	1.29
Durometer hardness, Shore A, ASTM		
D 676-55	73	67
Tensile strength, psi., ASTM D 412-		
51T	750	750
Elongation, %, ASTM D 412-51T	100	140
Tear strength, lbs./in., ASTM D 624-		
54 Die B	50	55
Brittle point, F., ASTM D 746-55T.	-100	-100
Compression set, after 70 hrs. @ 300°		
F., %	. 11	14
22 hrs. @ 480° F., %	55	80
Shrink, %, during molding	2.5	1.9
And curing	3.6	3.0



RUBBER CHEMICALS

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are made right for
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Get the full benefits of satisfactory performance *every* time with processing chemicals "tailor-made" by Witco for the rubber industry. Highest manufacturing standards insure uniform quality in Witco chemicals...guarantee good compounding results. And top technical service laboratories are freely on call whenever you want help with your processing or formulation problems.

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STEARATES

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...economical extending plasticizer.

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...ultrafine precipitated Calcium Carbonates for white rubbers.

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... non-staining, anti-sunchecking wax that inhibits atmospheric and corona cracking.

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...stearic acid for dispersing agent, plasticizer and accelerator-activity.

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... outstanding polyester for urethane foams.

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You can depend on MAGLITE D to provide instantaneous acid acceptance in Neoprene formulations. This not only means superior scorch protection, but also results in:

- 1. Reduced bin-cure and longer uncured stock
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- 4. Better mold-flow to permit such advantages as improved stock-knitting, reduced pre-cure laminations and shorter curing cycles at higher temperatures.

Stocks are quickly available from 15 strategically located warehouses. For samples of MAG-LITE D, K, L, and M, write MERCK & Co., INC., Marine Magnesium Division, Department RW3, Rahway, New Jersey.

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CMerck & Co., Inc

New Materials

Silastic S-2098II

	Vulcanized with Silastic	Vulcanized with 2,4-Dichloro- Benzovl
Property	S-2084	Peroxide
Color	red	red
Specific gravity, 77° F	1.32	1.32
Durometer hardness, Shore A, ASTM D 676-55	80	75
Tensile strength, psi. ASTM D 412-51T	850	850
Elongation, %, ASTM D 412-51T	90	100
Tear strength, lbs./in., ASTM D 624-		
54 Die B	50	60
Brittle point, °F., ASTM D 746-55T.	-100	-100
Compression set, after 70 hrs. @ 300°		
F., %	12	17
22 hrs. @ 480° F., %	55	85
Shrink, %, during molding	2.5	1.7
And curing	3.5	2.5

OIL RESISTANCE (WITH EITHER VULCANIZING AGENT)

% Swell after Immersion 70 Hrs. at 300° F.

	ASTM No. 1 Oil	ASTM No. 3 Oil
Silastic S-2096U	. 8	40
2097U	8	35
2098U	6	34

A technical data sheet, Bulletin No. P-9-302, giving more detailed information is available from the company.

New Kenplast Plasticizers

Kenplast RRNS, a processing oil for natural rubber, SBR, neoprene, and other elastomers to improve freeze resistance, is claimed to have excellent color, ultra-violet light stability, and low pour point. The results achieved at the 30-minute release in the compression set test with natural rubber with Kenplast RRNS show it to be more effective than dioctyl adipate, especially at the lowest temperature tested, -30° F. An increase in the plasticizer used will give not only better results than the ester, but will also reduce the cost of the compound.

Kenplast RRNS is a good processing oil for the SBR compounds, provided the amount used is increased as compared with DOA. The hardness data indicate that blends of Kenplast RRNS and dioctyl adipate give better results than dioctyl adipate alone. The physical data show improved softening effect of Kenplast RRNS when compared with dioctyl adipate. Hardness is lower; modulus is reduced; and elongation is increased. A reduction in cost of compounds results with the use of Kenplast RRNS in SBR. Improved low-temperature properties in SBR compounds can be achieved by its use.

Kenplast RRNS, when used with neoprene, helps reduce the internal viscosity, thereby improving resistance to stiffening. Lower freeze points are achieved by increase of Kenplast RRNS in formulations. It is effective in reducing stiffening at lower temperatures. While brittle temperature is very little affected, flexibility is improved. For low-temperature service Kenplast RRNS should be used in concentrations of 20-30 PHR to get the best results in neoprene.

An average analysis of Kenplast RRNS follows:

A	along liquid
Appearance	
Specific gravity 60/60° F	900 ± 005
Viscosity 100° F., Saybolt seconds	100
Pour point °F	-40
Color ASTM	
Aniline point, °F	170

Kenplast RD is another low-price efficient plasticizer for Neoprene WHV, standard SBR, 41° F. SBR, and for reclaiming HANDLE WITHOUT CARE

won't cling to paper and paperboard!

You'll save time, cut man-hours, when you process raw materials shipped to you in paper containers coated with the new Dow Corning SILICONE COATING. Sticky goods come free effortlessly.

And silicone coated interleaving sheets and packaging materials can speed operations within your own plant . . . make stick-free storage a reality.

Packaging with SILICONE COATING means big sales benefits to the shipper . . . shorter processing time, increased profits to the receiver.

Sticky products such as crude, camelback, adhesives, masterbatch compounds, and many resins, gums and bases can be unpacked quickly and cleanly. All the packaged product is easily made available . . . ready-for-use, uncontaminated.

SILICONE COATING is permanent, won't migrate. Colorless, odorless, it has no effect on the characteristics of paper except to improve water repellency. In cost, this new SILICONE COATING is comparable to ordinary anti-adhesive coatings. Ask your paper or package supplier for full details and samples, or write direct to Dow Corning Corporation.

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FREE BROCHURE

Provides more detailed information about SILICONE COATING; includes samples of silicone coated papers.



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REJECTS ARE A TOTAL LOSS!

There is very little you can do with scorched rubber except charge it off to experience. Even with the rapid modern accelerators, scorching is avoidable. With the Cambridge Surface Pyrometer, the operator can check, thus control the surface temperature of mill, warming and calender rolls. It is an accurate,

rugged, quick-acting instrument, so easy to use that operators are glad to use it.

Send for bulletin 194 SA

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THEY HELP SAVE MONEY AND MAKE BETTER RUBBER



New Materials

rubber. It is recommended as a plasticizer for such compounds wherever color is no drawback and is recommended for natural rubber and nitrile rubber in small proportions only. The material is useful for cable and wire jackets, extruded hose, gasket stocks, tubing, and rigid moldings. It is claimed to improve elongation and resistance to cracking and to give better processing and plasticity. Kenplast RD is low on volatile content and therefore shows low loss in properties of vulcanizates after accelerated

Some typical properties of Kenplast RD are as follows:

Gravity, API	11.5
Weight per gallon	
Flash, COC, °F	
Viscosity (a 100° F., SUS	
210° F., SUS	110
Pour point, °F	45
Mixed aniline point, F	
Color 5% solvent	

One of the outstanding properties of Kenplast RD and Kenplast RRNS is the ability to produce a low-viscosity vinyl plastisol when the plasticizers are used in plastisol compounds. These two Kenplast products are said to reduce the rate of viscosity increase when the plastisols are stored.

Technical bulletins on the aforementioned materials are available from Kenrich Corp., 57-02 48th St., Maspeth 78, N. Y.

Dow's Versenex 80

Versenex 80, a new chelating agent with potential uses in the rubber industry, is being produced in commercial quantities by The Dow Chemical Co. The product is effective in a broad range of chelating applications, but is especially valuable in controlling iron ions, according to Dow. One potential use is in the control of iron and other heavy metals that degrade finished polymerized

Versenex 80 differs from other Versene products in that it is based on diethylenetriamine; while the latter are based on ethylenediamine. Because of its higher molecular weight, more Versenex is required to chelate a given metal on a weight basis than is the case with other Versene products; however, the chelate structures formed with most metals are stronger and less susceptible to side reactions.

Versenex 80 is a concentrated aqueous solution of the pentasodium salt of diethylenetriamine pentaacetic acid, technical. It is also known as diethylenetriamine pentaacetic acid, pentasodium salt: diethylene trinitrilo pentaacetate, pentasodium salt; or as DTPANas.

Some typical properties of Versenex 80 are as follows:

Specific gravity, 25/25 C	1.31-1.33
pH (1% aqueous solution)	11.8 ± 0.5
Solubility in water	
Viscosity in cps, at 70° F	55

Samples of Versenex 80 and a technical data sheet are available from Dow's organic chemical sales, Midland, Mich.

Polyox Coagulant

A new organic flocculating agent, Polyox coagulant, with exceptional ability to increase the settling and filtration rates of dispersed solids, has been introduced by Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. It is a high-molecular-weight grade of the company's new family of Polyox water-soluble resins and the latest product in this unusual class of ethylene oxide polymers to reach the market. Among the several outstanding features of this new flocculent are: it effects complete sedimentation at low concentrations; gives good flocculation of solids over wide pH range; imparts toughness to floc; and has complete water solubility at low con-

The effectiveness of the reagent as a flocculent has already

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black for natural and synthetic rubbers. There's one exactly right for your formulation...and you can't buy better. Witco Chemical Company

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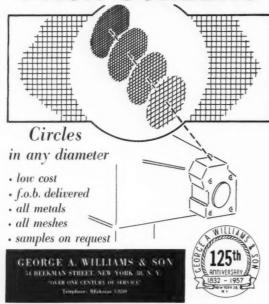
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Cut your costs on discs...

EXTRUDER PACK SCREENS



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GLUERS and
GEMENTERS

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APPLY LATEX GLUE & RUBBER

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VERSATILE. A variety of types and sizes 8" to 60" wide are available for short runs and production.

Small die-cut pieces as well as large sheets of thin or thick materials, foam pillows and upholstery cushions are cemented efficiently.

Schaefer MACHINE COMPANY, INC.

New Materials

been demonstrated in several systems—flocculation of silica suspensions, coal washery and other carbonaceous slurries, uranium ore slimes, and clay suspensions. It also exhibits ability to flocculate dispersions of polymeric organic materials. The reagent coagulates many types of synthetic latices prepared by the emulsion polymerization method and is useful in the manufacture of synthetic fibers, synthetic elastomers, and the like. Good coagulation results are also obtained on liquid dispersions of natural latices.

Some typical properties of Polyox coagulant follow:

Appearancewhite, granules
Softening point
Ash content, maximum (calculated
as calcium oxide)
Particle size98%, minimum, shall pass
through 10-mesh screen
Odormild
Moisture content, as shippedless than 1.5% by weight
Viscosity of 1% by weight concen-
tration in water at 25° C5500 cps. and higher

New RTV Silicone Compounds

A wide range of applications in the aircraft, electrical, and electronic, construction, dental, and other fields can be made with two new room-temperature vulcanizing (RTV) compounds developed by the silicone products department of General Electric Co., Waterford, N. Y.

Although requiring no special curing equipment or long curing times, compounds 81712 and 81726 offer many of the unique physical and electrical properties normally associated with silicone rubber. Both 81712 and 81726 are available in commercial quantities.

Among the uses for these compounds are encapsulation of electric and electronic components; sealing, and filling of voids; protecting parts against vibration and moisture; repairing or replacing rubber gaskets and seals; caulking and glazing; and model making.

A red compound, 81712 has extremely low shrinkage. It is suggested for model making, sealing, and other uses where accuracy and dimensional stability are important. Compound 81726, a beige material, is harder and tougher than 81712, but not so elastic. It shrinks about 2% during cure, several times more than 81712.

Excellent ozone and weathering resistance, flame resistance, low temperature flexibility, and good performance at temperatures as high as 500° F. are common physical characteristics of these RTV compounds. In addition, both possess good electrical properties.

Another outstanding feature shared by 81712 and 81726 is ease of handling. Both offer good storage stability, uniform pot life, and consistent curing characteristics. Cure times may be varied from several minutes to 48 hours, and pot life from two minutes to six hours.

Complete product and price information may be obtained from the Silicone products department, General Electric Co., Waterford, N. Y.

Bearflex 1751 Extender

The commercial availability of Bearflex 1751, a low-cost liquid hydrocarbon resin having high compatibility with polyvinyl chloride, has been announced by the chemicals division, Golden Bear Oil Co., Los Angeles, Calif. Bearflex 1751 is the first of a series of products for the plastics and rubber industries to be manufactured by Golden Bear, producer, refiner, and marketer of petroleum products.

A blend of 70% Bearflex 1751 and 30% dioctyl phthalate (DOP) gives a plasticizer system compatible in all proportions with PVC resin. Physical properties compared to a 100% DOP

(Continued on page 928)

FOR EVERY RUBBER COMPOUNDER

POLYME

A solid friable copolymer resin effective in highly-loaded GR-S and natural rubber stocks

STAINLESS PLASTICIZER

INCREASES FLEX-CRACK GROWTH RESISTANCE
INCREASES SHORE HARDNESS

MAINTAINS ABRASION RESISTANCE
INCORPORATES RAPIDLY

PROPERTIES

Physical Appearance	Friable, Solid
Color	
Odor	- A1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Specific Gravity	1.03
Melting Point	2.08 - 210 F.
Chemical Reaction	None Apparent

\$.1475 Truckload
.1575 Less than Carload
F.O.B. BALTIMORE, MARYLAND

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Compounding ingredients for Reinforcing, Plasticizing, Extending and Processing Natural and Synthetic Elastomers.

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C-130

The following chart is a nuclear batch compound showing the amount of POLYMEL C-130 necessary for a more efficient finished Vulcanizate.

POLYMEL C-130

	84	6	B	3	
GR-S 1502	70		70		
High Styrene					
Co-Polymer	30 40			30 10 40 5 0.5	
POLYMEL C-130			10		
Zeolex			40		
Zinc Oxide	5		5		
Heavy Mag. Oxide	5	5 5 0.5		5	
D.P.G.	0.5		0	0.5	
Santocure		.25	!	.25	
Neozone D	1		!		
Sulphur	3		3		
TOTAL	155.7	75	165	.75	
TENSILE (T)	% EL	ONGATIO	3) - (E)	
325° F.	T	E	T	E	
5 Min.	1300	230	1250	280	
o Min.		.210	1210	260	
10 Min.	1340	210	1410		

5 Min. 1200

10 Min 20 Min		1150
	SHORE HARD	IESS
5 Min	. 90	94
10 Min	. 90	94
20 Min	90	94
	PERMANENT	SET
5 Min	421/2	60 50 40
10 Min		50
20 Min		40

CURE 15 MINUTES AT 325 F.

Flex Resistance | 170,000 (Failed) | 3 mm at 731,000 (Removed) |

Abrasion | Resistance B. of S. | 24.5 | 24.8

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How Oakite Rustripper Improves Mold Cleaning

. SOAK TIME CUT

-from 24 brs. to 6 brs.

. COST PER MOLD CUT

-from \$7.21 to \$1.25

These results are from the report of a midwestern rubber company cleaning steel molds of heavy deposits of rubber and mold release lubricant. They prove again that it's faster and costs less to clean molds with Oakite Rustripper... and the molds come out cleaner, at that.

Maybe Oakite can help you, too, in lowering maintenance costs. Call your local Oakite man, or write for free booklet, "New Ideas in Cleaning for the Rubber Industry," to Oakite Products, Inc., 47 Rector Street, New York 6, N. Y.

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OAKITE

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NEW

PRODUCTS



Installation of Goodrich expansion joint

Goodrich Expansion Joint

Development of a unique rubber expansion joint designed to eliminate the rhythmic road shock motorists encounter on many highways and to make smoother aircraft landings possible on airport runways has been announced by B. F. Goodrich Industrial Products Co., Akron, O.

The joint is said to be an entirely new concept in rubber expansion joints as it permits, for the first time, as much as three inches of contraction and expansion in the highway or runway while keeping the rubber flush with the surface.

The joint is made of a synthetic rubber specially compounded to absorb movement of the highway or runway in cold or warm weather. A series of metal plates is bonded to the rubber to carry the vertical loads imposed on the joint by traffic. Anchored between road sections for a watertight seal, the joint is about 13 inches wide and extends the width of the highway or runway and fully fills the joint connection to its required depth.

Originally developed for the Jones & Laughlin Steel Corp.'s new prestressed concrete highway, the rubber expansion joint is also being designed for use on bridges and bridge approaches as well as on new highways and airport runways. It was reported that many people connected with the federal highway construction program have expressed interest in the new joint, and a number of states are planning to use it in experimental highway sections.

Goodyear NoScrub Flooring

The Goodyear Tire & Rubber Co., Akron, O., recently introduced at the winter market in Chicago its new, low-cost vinyl flooring, "NoScrub." The new line, produced in nine-by-nine tile form and residential gage only, consists of 12 light popular decorator colors— 10 terrazzo and two wood grain patterns.

This flooring will prove economical because of a new manufacturing technique, which consists of annealing a heavy-duty vinyl to a quality vinyl backing, utilizing a special Goodyear printing. The flooring is said to have premium styling, excellent adhesion, and the long-wear and self-maintenance characteristics which are associated with the Goodyear company's custom or deluxe lines.



new idea in extidue

The Aetna-Standard Engineering Company announces an important new development in extruders . . . the Kullgren Temperature Control System.*

This unique system uses electric induction heat and evaporative cooling. These are the advantages:

Economy: Heating power costs a fraction of that required for conventional methods.

Response: Generation of the heat in the liner itself provides fast temperature build-up of approximately 15° per minute at operating temperature. Evaporative cooling permits reduction of temperature at rates up to 50° per minute. No "overshoot" from control

point since the generation of heat is at sensing point for thermocouple.

Uniformity: Heat generation in the liner by induction assures complete uniformity within the zone.

Control: Temperatures are maintained within very close limits under widely varying requirements of heating or cooling.

Maintenance: Heater replacement or maintenance eliminated . . . coils operate at moderate temperatures.

We specialize in special extruders for plastic or rubber.

*Patent Applied For

The AETNA-STANDARD

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Pittsburgh, Pennsylvania
SALES AND ENGINEERING
HALE & KULLGREN, INC.
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Please address your inquiry to: Hale and Kullgren, Inc., 613 E. Tallmadge Ave., Akron, Ohio.

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Whatever your problems...processing rayon or nylon cord, fabrics, carbon blacks, etc. . . . I.T.A.'s expert staff of technicians and teachers can help you.

Through I.T.A. you get the latest up-to-the-minute methods you need—at surprisingly low cost. If you wish, Dayton technicians will design your factory or supervise machinery installations: Write International Technical Assistance Division, Dayton Rubber Company, Dayton 1, Ohio, U.S.A.

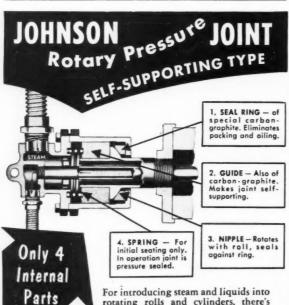
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Dayton Rubber

Manufacturer of Tires, Tubes, V-Belts, Rollers, Polyurethane Products and other highly specialized and technical rubber products.

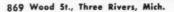


For introducing steam and liquids into rotating rolls and cylinders, there's nothing like the Johnson Joint above, It's packless, self-lubricating, self-adjusting, self-supporting. It has been

adopted by dozens of machinery makers, and is finding new uses every day.

Type SB shown handles both steam and condensate through same head; also available for through flow service, and in sizes and styles for all operating conditions. **Write for literature.**

The Johnson Corporation





New Products

Silicone Rubber Tapes

Raybestos-Manhattan, Asbestos Textile Division, Manheim, Pa., recently developed a new line of silicone rubber-coated Novabestos sheets and tapes. These new products were designed for use as primary and secondary insulation in shipboard cables and other types of power cables. The tapes and sheets, supplied in two styles, 7526 and 7527, will withstand greater shock vibration and abuse than glass-cloth-base tapes as well as providing a 15 to 30% savings in unit-area cost. These tapes and sheets have excellent resistance to dry baking heat and good oil and moisture resistance. The insulation stays together after severe flame exposure, and the tapes promise numerous applications in addition to their originally intended usage.

Style 7526 Novabestos is supported with parallel strands of glass yarn which provide a unidirectional tensile of 75 pounds per inch of width. This is said to be more than adequate for taping head application. Style 7527 is reinforced with a glass scrim providing a lengthwise tensile of 75 pounds and a crosswise tensile of 50 pounds per inch of width. Style 7526 can be overlap-

ped: while style 7527 must be butt wrapped.

The composition of the Novabestos base sheet is 75-80% asbestos fiber and 12-20% glass fiber. The combined product will withstand a greater amount of shock vibration and abuse than will similar glass-cloth-base sheets and tapes. The asbestos fiber

gether after severe flame exposure, an important attribute in marine and aircraft applications.

Styles 7526 and 7527 Novabestos tapes have good moisture resistance and very acceptable oil resistance. They also have

reinforces the silicone rubber and will hold the insulation to-

excellent resistance to dry baking heat.

The silicone rubber used to impregnate styles 7526 and 7527 tapes is of the self-curing type. The addition of a catalyst to the viscous rubber causes it to cure in four to six hours. A wipe of the resistance of the insulation to voltage breakdown. It will also cracks between butt-wound tapes. This will materially increase-the resistance of the insulation to voltage breakdown. It will also assist in the achievement of a watertight construction.

It is anticipated these new products will find numerous applications other than the originally intended usage as primary and secondary insulation in shipboard cable. Number 7527 sheet is currently being tested for use in the windings of dry transformers, with an indicated worthwhile cost saving to the equipment manufacturer. Additional information and samples are available from the company.

Bearflex Extender

(Continued from page 924)

compound are not affected appreciably; electrical properties are improved.

Bearflex 1751 is recommended for extruding vinyl compounds used to produce film and sheeting, garden hose, electric insulation, profile extrusion, dip coatings, and slush-molded products. The material is particularly useful for extending non-migrating vinyl compounds which contain polymeric plasticizers. Cost is lowered without affecting non-migrating qualities of the plasticizer system. Bearflex 1751 is also a highly compatible extender for synthetic rubbers, including nitrile rubber and neoprene.

Some typical physical properties of Bearflex 1751 follow:

Specific gravity 60° F./60° F. 1.006 Pounds per gallon (60° F.) 8.38 Flash point (COC) 390° F. Fire point (COC) 430° F. Pour point -5° F. Refractive index (20° C.) 1.570 Viscosity @ 100° F. 90 cps. 210° F. 5.6 cpt
Flash point (COC) 390° F. Fire point (COC) 430° F. Pour point -5° F. Refractive index (20° C.) 1.570 Viscosity @ 100° F. 90 cps.
Fire point (COC) 430° F. Pour point -5° F. Refractive index (20° C.) 1.570 Viscosity @ 100° F. 90 cps.
Pour point -5° F. Refractive index (20° C.) 1.570 Viscosity @ 100° F. 90 cps.
Refractive index (20° C.) 1.570 Viscosity @ 100° F. 90 cps.
Viscosity @ 100° F 90 cps.
210° F
Odor very sligh
Color, NPA (ASTM)
Mixed aniline point (50:50 n-heptane) 25.5° C.

A technical data sheet, PL-1, is available from the company.

TECHNICAL

BOOKS

BOOK REVIEWS

"Rubber Red Book." 1957-1958 Edition. Eleventh Issue. Edited by M. E. Lerner. Cloth cover, 6% x $9\frac{1}{4}$ inches, 1458 pages. Published by *Rubber Age*, New York 1, N. Y. Price \$12.50.

This book is essentially a directory of the rubber industry. It is 209 pages fatter (at a price increase of \$2.50) than the 1955-56 edition, which, according to the Editor, is due to an increase of 200 additional manufacturers and 347 plants and "reflects the continuing growth of the rubber manufacturing industry."

The coverage of the industry and its suppliers is excellent. There is little new in the section headings and general organization of the book. Listings of rubber chemicals are sometimes awkward; for example, the imidazoline group has been dropped from the scheme of classification of organic accelerators, and accelerator NA-22 (2-mercapto-imidazoline) has been listed under miscellaneous types. Another unusual quirk of classification lists zinc stearate as a filler along with such materials as silica and clay.

The book is a necessary piece of equipment for most technologists, purchasing agents, and sales organizations to the rubber industry.

"Catalysis in Practice." Edited by C. H. Collier. Cloth cover, 5½8 x 7½6 inches, 158 pages. Reinhold Publishing Corp., New York, N. Y. Price, \$3.95.

This book is essentially a collection of papers presented in Philadelphia, Pa., at the Fifth All-Day Meeting sponsored jointly by the Philadelphia-Wilmington Section of the American Institute of Chemical Engineers and the School of Chemical Engineering of the University of Pennsylvania.

Chapter headings are: What Catalyst and Why; Commercial Preparation of Industrial Catalysts; Fixed Bed Catalyst Systems; Moving Bed Processes; The Economics of Catalyst Use; Operating Problems in Catalytic Processing; Trends and Prospects in

Catalysis.

The writing is brief and concise and confined to existing technology within the chemical and petroleum industries. The depth of the presentations is that generally associated with the review type of article. The book suffers from a lack of bibliography, and the editor did not choose to index his work.

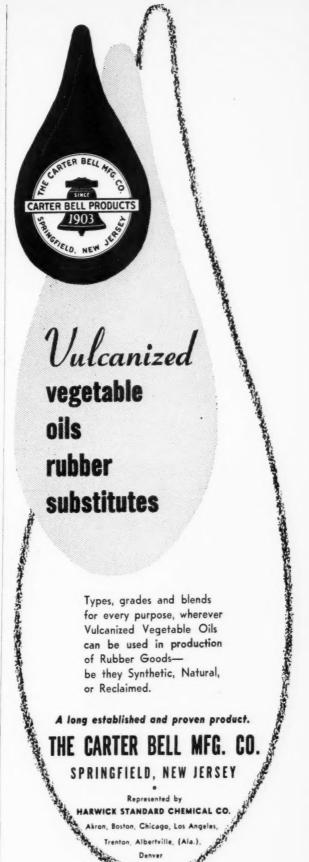
In the concluding chapter, Trends and Prospects in Catalysis, some mention is made of the use of "stereo-specific" (e.g., Karl Ziegler type) catalysts in making low-pressure polyethylene and

'synthetic" natural rubber (an isotactic polymer).

The specialist and long-time worker in the field will find little in this book of value to him. The beginner and young practicing chemical engineer, however, may find it a useful introduction to the subject.

NEW PUBLICATIONS

"Rubber Map of the World." Naugatuck Chemical, Division of United States Rubber Co., Naugatuck, Conn. 6 pages. A world map showing the sources of natural and synthetic rubber, United States consumption of each for 1956, import-export data by countries, and the company's line of latices and rubbers for industrial use are presented in this informative brochure.



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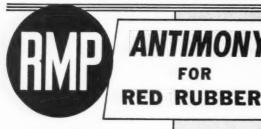
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Technical Books

Publications of The Goodyear Tire & Rubber Co., Akron, O., "Rotational Molding Plastisol," TBF 57-81. 2 pages. This data sheet gives a recommended formulation using a blend of Pliovic AO and Pliovic S-70 in the manufacture of plastisol playballs, duck decoys, and other hollow products. Formulations and a viscosity-temperature plot are included.
"Cove Base Formulation." TBF 57-9. 1 page. A dry-blend

cove base formulation, the typical physical properties, and extrusion conditions are given for a low-cost vinyl compound

based upon Pliovic DB80V.

"Compounding: Volatile Diluents in Pliovic AO Plastisols." TBF 57-19. 2 pages. This sheet presents a study of the effect of various concentrations of diluents on plastisol viscosities and a plot depicting the plastisol viscosity versus parts diluent per 100 parts resin.

"Compounding Study: Plasticizer Evaluation in Pliovic AO Plastisols." TBF 57-205. 12 pages. This data sheet lists a table of recommended primary plasticizers for Pliovic AO plastisols, recommended secondary plasticizers, the chemical type of each plasticizer, the evaluation procedure, and the results obtained

from the two types of plasticizers.
"Metal Coating Organosol." TBF 57-10A. 2 pages. The basic organosol compound formulation, the physical properties of the film, the compounding procedure, and application data are given for organosols based on Pliovic AO vinyl dispersion resin used

in metal coating applications

Publications of E. I. du Pont de Nemours & Co., Inc., Wil-

"Index to Technical Reports." 22 pages. This bulletin lists the title, report number, and date of publication of the department's formal reports, BL reports, and PR reports issued from 1951 to

1957. A subject index is included.

"Neoprene Latex Foam." BL-335. J. C. Carl and T. E. Betchel. 8 pages. The compounding and the processing of neoprene latex foam are briefly reviewed. A new acceleration system is presented which will produce foam from Neoprene Latex Type 60 with improved physical properties and better processability.

Selection of latex type for specific uses is also discussed.

"Neoprene Toy Balloons." BL-334. T. E. Betchel. 4 pages. This booklet discusses the properties and processability of Neoprene Latex Type 750 balloons. The balloons are easy to inflate, retain air or gas for long periods, and resist attack by ozone. This bulletin also contains compounds for such balloons and describes their properties.

"End Rings for Oil Well Packers." T. D. Bolt. No. GD-19. Godfrey L. Cabot, Inc., Cambridge, Mass. 2 pages. This data sheet gives the formulation and the physical properties of the vulcanized acrylonitrile rubber (NBR) compound used in end rings in oil-well packer applications. A high loading of Sterling MT provided high modulus and good tear resistance for minimum extrusion flow and surface cracking.

"Ethylac." S-130. Pennsalt Chemicals Corp., Philadelphia, Pa. 4 pages. This data sheet lists the properties of Ethylac, a nonstaining and non-discoloring primary accelerator and gives test data on various compounds accelerated with thiazole-type accelerators activated with Ethylac. Ethylac (2-benzothiazyl-N, N-diethylthiocarbamyl sulfide) is a light yellow, low melting powder, essentially dustfree.

"Eastozone Antiozonants for the Rubber Industry." Eastman Chemical Products, Inc., Kingsport, Tenn. 4 pages. This brochure discusses three rubber antiozonants, designated Eastozone 30, 31, and 32, and the manner in which they protect rubber and rubber products against the deteriorating effects of ozone and includes performance characteristics, chemical structure and name, molecular weight, and typical properties of each type. This bulletin is intended as an aid to rubber processors in their selection of an antiozonant to meet specific requirements. Eastozone 30, 31, and 32 are, respectively, N,N'-di-2-octyl-p-phenylenediamine, N,N'-di-3-(5-methyl-heptyl)-p-phenylenediamine, dimethyl-N,N'-di-(1-methylpropyl)-p-phenylenediamine.

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RUBBER WORLD

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Publications of Phillips Chemical Co., Akron, O.:

"Blends of Philprene 1708 and Natural Rubber for Industrial Goods." No. 31. 4 pages. This technical data sheet gives a summary of physical properties of various vulcanizates of Philprene 1708 and natural rubber. The data illustrate the effects of substituting Philprene 1708 for natural rubber in 25% increments in neutral-colored stocks and in compounds containing carbon black. Complete physical data are included in tabular form.

"Philprene 1010." 2 pages. This data sheet gives the specifications and typical properties of Philprene 1010, a hot, non-pigmented, non-staining SBR copolymer. It is designed primarily

for chemically blown sponge.

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"Philprene 1100." 2 pages. This data sheet lists the specifications and typical properties of Philprene 1100, a hot, pigmented, staining SBR copolymer mixed with EPC carbon black and a

staining antioxidant.
"Philprene 1104." 2 pages. This data sheet covers the specifications and typical properties of Philprene 1104, a hot, pigmented, non-staining SBR copolymer mixed with FEF carbon black and a non-staining antioxidant. The rubber is used exten-

sively in calendered, extruded and molded goods. "Philprene 1600." 2 pages. This data sheet deals with the specifications and typical properties of Philprene 1600, a cold, pigmented, staining SBR copolymer mixed with HAF black and a staining antioxidant. The rubber is used in tires, camelback, and mechanical applications where the greater reinforcement of HAF black is desired.

Publications of Harwick Standard Chemical Co., Akron, O.:

"Thixon Primer P-3 Rubber-to-Metal Bonding Primer." #03-17-0-11-57. 2 pages. This technical data sheet gives the function, composition, properties, application, and agitation information on a primer for bonding natural rubber, SBR, neoprene, and butyl stocks to metals, with suggested secondary cements. The primer is manufactured by Dayton Chemical Products Laboratories, Inc.

"Harwick Clays in Rubber." #01-13-2-11-57. 2 pages. Typical analysis, specifications, uses, and comparative data are presented in this data sheet on the company's water-fractionated clays. These clays are of fine particle size, white, inert, and soft textured, processed to remove hard particles, sand, mica, water

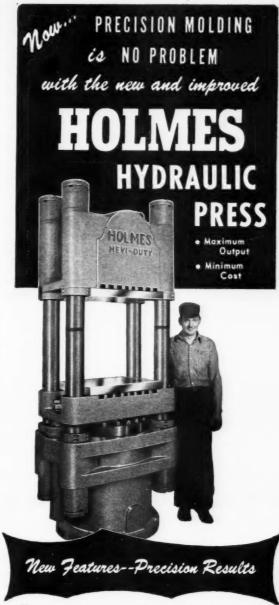
soluble salts, and moisture.

"Thixon UM-1 Rubber-to-Metal Bonding Adhesive." #03-20-0-12-57. 2 pages. The function, composition, properties, consistency, and application data of Thixon UM-1 are described. Thixon Um-1, a one-coat cement for vulcanization bonding of polyurethane stocks to metal, is manufactured by Dayton Chemical Products Laboratories, Inc.

"Duo-Torque Transmission." Bulletin 1399. Baker-Raulang Co., Cleveland, O. 4 pages. This well-illustrated bulletin, available upon request, describes the new Baker Duo-Torque transmission for industrial trucks. The transmission is said to combine the most desirable features of both the torque converter and the fluid coupling with the added advantage of a power shifted twospeed transmission.

"Fawick Rotorseals." Bulletin ML-177. Fawick Airflex Division, Fawick Corp., Cleveland, O. 6 pages. This new folder describes functions and applications of Fawick Rotorseals and quick-release valves. Complete dimensional and technical data are presented on the Rotorseals, which are used as a means of transmitting air, liquid, or gases under pressure or vacuum from a stationary source into a rotating shaft. A section of the bulletin describes in detail the company's quick-release valves, used to provide quick evacuation of pressurized air from pneumatic

"Isotopes and Isotope Labeled Compounds." Bio-Rad Laboratories, Berkeley, Calif. 16 pages. This publication, a new price list covering radioactive isotopes and isotope-labeled compounds, adds to previous issues an expanded list of carbon-14 compounds and new sections describing heavy water, deuterium- and tritiumlabeled compounds, and new nitrogen-15 compounds of high isotopic concentration. It contains a convenient alphabetical list and cross-reference as well as under stable isotopes, heavy water and deuterium gas, and deuterium labeled compounds.



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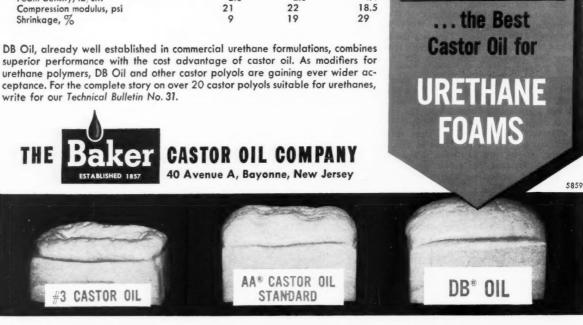
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For top quality in urethane foam, specify DB Oil, the castor oil especially designed by Baker for urethane polymers. In the comparative semi-rigid foams, illustrated below, employing Baker's three available grades of castor oil, the foam based on DB Oil gave a minimum shrinkage. These physical tests confirm the visual differences:-

	DB®	AA®	#3
Prepolymer viscosity, cps @ 25°C	7,900	8,515	12,520
Foam density, lb/c.f.	2.3	2.5	4.4
Compression modulus, psi	21	22	18.5
Shrinkage, %	9	19	29



Technical Books

"Kenflex." Kenrich Corp., Maspeth, N. Y. 9 pages. This publication gives the physical properties of the company's five solid Kenflex resins and of five liquid or semi-liquid Kenflex resins and plasticizers, including their functions, applications, uses, and compatibilities. Kenflex is described as a synthetic polymer of aromatic hydrocarbons which is manufactured exclusively by Kenrich from selected aromatic petroleum fractions for higher aromaticity in resin. A Kenflex processing aid, a synthetic polymer of aromatic hydrocarbons, is also described, and its advantages are listed.

"The BFG Hi-Torque Brake." B. F. Goodrich Aviation Products, division of The B. F. Goodrich Co., Akron, O. 4 pages. This brochure describes the use of the company's Hi-Torque brakes for heavy-duty and off-highway construction vehicles and explains how the brakes increase the service life of heavy equipment and how the brake permits quick stopping. Complete specifications are also listed. The Hi-Torque is said to be the first hydraulic drum-type brake with 360-degree expander tube actuation designed exclusively for large tractors, scrapers, and earth-movers.

"Amsco Chemicals—Building Blocks for Industrial Progress." American Mineral Spirits Co., Chicago, Ill. 8 pages. This technical brochure presents chemical formulae and test results on alcohols, esters, glycols, ketones, chlorinated solvents. plasticizers, and miscellaneous solvents. A solvent resin guide for these solvents is featured.

"Cellular Butyl Rubber." Rubatex Products, Inc., Melrose. Mass. This news-letter gives a recommended formulation of cellular butyl rubber, directed toward Rubatex licensees, processing data, and suggested technical problems, the solution of which may lead to new applications for cellular butyl rubber.

"Carbowax Polyethylene Glycols." Union Carbide Chemicals Co., New York, N. Y. 54 pages. This booklet describes the properties, applications, storage, specifications, and testing of the company's Carbowax polyethylene glycols. These compounds are water-soluble, non-volatile, unctuous liquids and solids used for water-soluble lubricants, cosmetics and ointments, emulsifying agents, adhesives, and paper coatings. Following a general description of the materials, there is a table of physical properties, including solubilities in common solvents and compatibilities with common ingredients of formulated products. A 16-page section describes in detail the applications of the glycols in such industries as rubber, pharmaceutical, textiles, cosmetics, cleaners and electronics.

"Mathieson Industrial Chemicals." Olin Mathieson Chemical Corp., Baltimore, Md. 16 pages. This booklet, describing the characteristics, grades and containers for 24 basic chemicals used by industry, contains information on organic, inorganic, and specialty chemicals and lists the location of the production points for each product.

"V-belts, the Testing, Inspection, and Control of Their Quality." S-51107. The Goodyear Tire & Rubber Co., Akron, O. 16 pages. This informative booklet, the fourth in a series, describes in words and with pictures how raw materials and finished belts are tested and inspected. One section of the booklet explains quality control procedures; another is concerned with experimental production. Copies are available gratis to interested readers.

"Carbon-14 Labeled Compounds." Research Specialties Co.. Berkeley, Calif. 8 pages. The selection of compounds which the company regularly manufactures has been greatly increased in this new listing, particularly among the purines and pyrimidines. As the company specializes in custom syntheses, it is also able to offer many other compounds on a special order basis. A new format is intended to make the price list convenient to use.

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"Castor Oil Products for Urethane Polymers." Technical Bulletin No. 31. The Baker Castor Oil Co., Bayonne, N. J. 24 pages. Emphasizing the value of castor oil and its derivatives as basic materials in modifying urethane polymers, this technical bulletin discusses the more than 20 derivatives of the company's castor oil currently or potentially useful in urethane modifications illustrating their advantages in such applications as rigid and flexible foams, elastomers, coatings, and adhesives. Many of the derivatives have been prepared at the express wish of urethane researchers.

"Dimethylol Phenol Curing System in Butyl Rubber and Effects of Various Activators." Bulletin 100-4. Thiokol Chemical Corp., Trenton, N. J. 16 pages. This bulletin is intended to provide the compounder with a basic background for utilizing dimethylol phenol resins as vulcanizing agents for butyl rubber compounds for a great number of applications. Some advantages of this system of resin cure are reported as outstanding heat resistance, excellent resistance to compression set, non-blooming, non-staining, and very good tasteless and odor-free properties. Rubber manufacturing companies wishing to obtain a licensing agreement to use the dimethylol phenol cure should write to: United States Rubber Co., Legal Department, 1230 Avenue of the Americas, New York, N. Y. The bulletin presents the study and the results of the curing system, utilizing certain halides as catalysts.

"Questions and Answers on X-Ray Diffraction, Diffractometry, and Spectrography." Philips Electronics, Inc., Mount Vernon, N. Y. 16 pages. In this booklet 71 questions and answers cover points most frequently raised by people who have attended Norelco X-ray Diffraction Schools during the past 10 years. Data deal with camera, diffractometer, and spectrograph equipment and techniques. This booklet explains specimen preparation and describes fields of application for the three basic X-ray analysis methods. Also discussed are the selection of analyzing crystals and calibration of the spectrograph for quantitative work on elements.

"Wood Tanks: Reference and Data Handbook." National Wood Tank Institute, Chicago, Ill. 28 pages. This comprehensive booklet includes such subjects as: the uses of wood tanks: capacities: physical and chemical properties of wood and their relation to expected service of wood tanks; and the use of selected polymer linings to cover severe conditions found in the chemical processing industries. The carefully indexed manual may be obtained from the Institute.

"Still-Seal Gaskets." Stillman Rubber Co., Culver City, Calif. The firm's leakproof static seals with full metal-to-metal contact are described in detail in a two-color illustrated catalog sheet. Suitable for sealing in a wide range of fluids at pressures from vacuum to more than 5,000 psi. and at temperatures from —80 to 500° F., the one-piece gasket eliminates the necessity of costly and difficult close tolerances common to other static sealing methods. Copies of the catalog sheet are available from the company.

"Sturtevant Micronizer Grinding Machine." Bulletin No. 091. Sturtevant Mill Co., Boston, Mass. 4 pages. This bulletin describes fluid energy grinding and gives typical grinding data for various materials. Information is given on how to obtain custom or experimental fine grinding service from the company. A cross-section drawing of the Micronizer is shown, and a flow sheet of a complete fluid energy grinding unit is included. Sizes, pressure requirements, and capacities are tabulated.

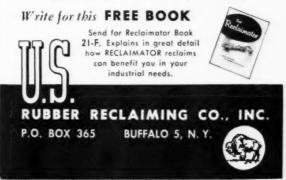
"Pyrazines—Reactions and Applications." Wyandotte Chemicals Corp., Wyandotte, Mich. 24 pages. This booklet is a survey of the most recent and significant literature in the field of pyrazine chemistry. Of particular value will be the application information covering data on the preparation of pharmaceutical products, high polmers, insecticides, and dyes from the pyrazines. Reactions and physical properties of pyrazine, methylpyrazine, 2,5-dimethylpyrazine and their derivatives are included together with an extensive biblography.



the RECLAIMATOR process is now available on a licensing basis all over the world.

This is the only continuous and completely DRY process for reclaiming rubber. From beginning to end, devulcanization in the RECLAIMATOR takes only 3 minutes. Because of this short cycle time more of the desirable properties are left in the rubber. And . . . this process is AUTOMATIC and electrically controlled — no steam plant is required.

If you are interested in learning how you can install the RECLAIMATOR to produce high quality reclaimed rubber at low cost, simply write us a letter. Our years of experience in the field and our laboratories and engineering departments are at your disposal.



MARKET

REVIEWS

Natural Rubber

During the January 16-February 15 period, general easing of rubber went full circle as dropping prices abroad, prompted by previous declines here, caused a further decline in this market. Cable offerings, although heavier than they have been, were still considered light, and they were largely unsold. Actual sales were reported at times during this period at a standstill, with factory buying at a low level. Dealer hedging against actual purchases were features in rubber futures trading. Business was generally described as extremely quiet, and little consumer interest was evident.

The New York market continued to labor under the shadow of contraction in the automotive industry and disappointing consumption as shown by previous figures. Shipment offerings have been fair, but manufacturers' interest has been negligible, which in some quarters is partly ascribed to the heavy stocks of synthetics at the end of the year and undoubtedly also to the factory stocks of natural rubber, which, according to a recent return, amount to close on two month's supply.

It is believed that the recent setting up of a Special United States Stockpile Advisory Committee for the purpose of reviewing the stockpile situation in relation to present-day conditions has been regarded with some anxiety by the natural rubber producing industry and by the markets. The report of the stockpile committee was released on January 28, and rubber goods manufacturers and rubber dealers differ as to its findings and recommendations (see Washington Report, this issue). One group sees in the report a mandate

for at least partial liquidation of the natural rubber stockpile, and the other feels that only a token attempt at stockpile reduction has been recommended. In any event, the report has had a dampening effect on speculative natural rubber trading.

January sales, on the New York Commodity Exchange, amounted to 10,910 tons, compared with 20,560 tons for December; none on the Rubber-Standard Contract. There were 22 trading days in January; and 21 during the January 16-February 15 period.

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 26.46¢ per pound for the January 16-February 15 period. Average January sellers' prices for representative grades were: RSS #3, 25.91¢; #3 Amber Blankets, 25.00¢; and Flat Bark, 20.73¢.

Production of these rubbers in January at 102,663 long tons was only slightly less than in December when 103,779 tons were produced. By types, this production in January, as compared to December output, was reported as follows: SBR, 85,350, against 85,223; CR, 8,804, against 9,568; IIR, 6,149, against 6,469; and NBR, 2,360, against 2,519.

Exports of synthetic rubbers in January amounted to 19,710 tons, in contrast to the 18,310 tons sent abroad in December. By types the amounts exported were about equal in January except for neoprene which rose from 1,790 tons to 2,900 tons.

Although stocks on hand rose in January to 213,004 tons from the 201, 149 tons on hand in December, these stocks cannot be considered excessive.

It is expected, however, that the synthetic rubber picture for February may be somewhat less encouraging as the effects of recent automotive cutbacks are felt. Producers are looking for improvement in the second quarter of the year as sales of autos and military requirements for rubber products may show some improvement.

Although the pressure on the profit margins of synthetic rubber producers continues to mount, no price changes have been announced, and the trade has no comment in this connection.

Synthetic Rubber

According to figures in the regular monthly report of The Rubber Manufacturers Association, Inc., consumption and exports of synthetic rubbers increased in January over December, 1957, figures, despite the general slowing down of business activity throughout the country.

Consumption of synthetic rubber during January amounted to 71,386 long tons, compared with December consumption of 67,509 long tons. By types compared with December, the various synthetic rubbers were consumed in January as follows: SBR, 59,307 tons, against 56,345 tons; neopene (CR), 5,789, against 5,531; butyl (IIR), 4,390, against 3,884; and nitrile (NBR), 1,900, against 1,749.

Latex

Although there has been some interest for shipment during March and April, the immediate surplus of drum latex continues to have a depressing effect on the liquid latex market. In consequence, the differential for drum latex has been declining, and, provided the free flow of latex from Indonesia continues uninterrupted, it seems that to halt or reverse the present trend will require a considerable improvement in buying interest. The Malayan production in December was reported at 10,-227 tons, compared with 10,314 tons in November, giving a total for the year of 107,996 tons (88,047 tons produced in 1956).

The United States consumption of

	RE	X CONTR	ACTS			1	NEW YOU	RK OUTSIE	E MARKET		
1958	Jan. 17	Jan. 24	Jan. 31	Feb. 7	Feb. 14		Jan. 17	Jan. 24	Jan. 31	Feb. 7	Feb. 14
Jan	26.80	26.50				RSS #1	27,00	26.63	26.75	26.25	25.88
Mar	27.30	26.65	26.75	26.25	26.00	2	26.50	26.13	26.25	25.63	25.25
May	27.58	27.05	27.10	26.65	26.29	3	26.00	25.63	25.13	25.00	24.50
July	27.65	27.05	27.20	26.90	26.55	Pale Crepe					
Sept.	27.68	27.20	27.30	26.90	26.65	#1 Thick	29.75	29.13	29.00	28.50	28.38
Nov	27.70	27.20	27.30	26.90	26.70	Thin #3 Amber	29.75	29.13	29.00	28.50	28.38
Jan.	27.70	27.20	27.30	26.90	26.70	Blankets	25.00	24.63	24.38	24.00	23.75
Mar			27.30	26.90	26.70	Thin Brown					
				20,20	20.70	Crepe	24.38	23.63	23.88	24.00	23.13
Total weekly sales,						Standard Flat					
tons	1.230	1.880	3.800	2.790	2.480	Bark	20.75	20.38	20.50	20.38	20.38

ing.

NO. 15 OF A SERIES

Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

New Rubber Chemicals Application Laboratory at Bound Brook

A fine new Rubber Chemicals Application Laboratory is now in full-scale operation at Cyanamid's Bound Brook plant. Functionally designed to incorporate the latest equipment, the laboratory provides maximum efficiency in test programs involving the evaluation of new rubber chem-

icals, as well as development of existing ones, to improve their physical and chemical properties. Responsibility for original research on rubber chemicals will largely be the function of the Rubber Chemicals Research Section of Bound Brook's Product Research Department.

Cyanamid's rubber chemicals "have quality...impart quality." This claim will be strengthened even more by the new laboratory...users of rubber chemicals will benefit to the full through better-than-ever service on better-than-ever products.



The laboratory is fully equipped to perform all compounding and physical testing operations. The air-pressure vulcanizer shown is being loaded with rubber test samples.



An example of the laboratory's special equipment is this unique cell oven-aging method which prevents contamination of rubber test samples by migrating and subliming components.



In the evaluation of non-staining antioxidants, an important test is determining the rate of discolaration of white rubber stock with a sun lamp rich in ultraviolet rays.



Measuring tensional creep of rubber sample at constant temperature by cathetometer reading. This and other tests are used to check both production lots and new development chemicals.



Unloading a midget Banbury. Successful completion of laboratory trials is followed by further formulation evaluation in pilot-plant size Banburys and other mixers.



Testing crack resistance in an ozone atmosphere. By exhaustive investigation into all rubber chemicals applications, the laboratory will make major contributions to the rubber industry.

natural latex during December is reported at 6,006 tons, against 6,783 in November. U. S. stocks at the end of December were 14,299 tons, compared with 12,315 tons on November 30.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b., rail tank cars, ran about 34.91¢ per pound solids. Synthetic latices were 22.5 to 31.2¢ for SBR; 37 to 55¢ for neoprene; and 46 to 65¢ per pound for nitrile types.

Final November and preliminary December domestic statistics for all latices were reported by the United States Department of Commerce as given below:

(All Figures i	n Long	Tons,	Dry	Weight)
Type of Latex	Pro- duc- tion	Im- ports	Con- sump- tion	
Natural				
Nov.	0		6,783	
Dec.	0		6,006	14,299
SBR				
Nov	6,515	_	5,776	7,558
Dec.	5,915	-	5,194	8,662
Neoprene				
Nov.	1,021	0	725	1,265
Dec.	704	0	651	1,155
Nitrile				
Nov.	994	0	712	1,927
Dec.	734	0	499	1,530

Scrap Rubber

Slow trading continued to mark the scrap rubber market during the period under review (January 16-February 15). The Naugatuck reclaimer was taking in only tubes, mainly butyl, and not accepting any mixed auto tires. Consequently the mixed auto tire price was nominal; the \$11.00 quotation for shipment to Buffalo still applied.

	Eastern Points Per Net	Akron, O. Ton
Mixed auto tires	\$8.00-\$11.0	\$12.00
S. A. G. truck tires	Nom.	15.50
Peeling, No. 1	Nom.	23.00
2	Nom.	20.00
3	Nom.	15.50
Tire buffings	Nom.	Nom.
	(é per l	Lb.)
Auto tubes mixed	2.75	2.75
Black	6.25	6.25
Red	6 80	7.00
Butyl	3.50	3.75

Reclaimed Rubber

The reclaimed rubber business was reported to have held up quite well during the January 16-February 15 period, but toward the end of this time it slowed down considerably, owing to the slowdown in the automotive industry. The major reclaimers did not foresee any particular increase in reclaim usage at this time.

According to The Rubber Manufacturers Association. Inc., report, January production of reclaimed rubber reached 20,600 tons; while consumption was 21,700 long tons.

RECLAIMED RUBBER PRICES

Whole tire, first line	0.11
Third line	.1025
Inner tube, black	.16
Red	.21
Butyl	.14
Light carcass	.22
Mechanical, light-colored, medium	
gravity	.155
Black, medium gravity	.085

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity, at special prices.

Industrial Fabrics

Mills are continuing to cut back production wherever possible on wide industrial fabrics because of the almost complete halt in new orders and slowdown in deliveries of cloth to automanufacturers. Output of industrial cloths is being reduced by various methods. Mills are shifting looms, where this can be arranged, from fabrics such as wide sateens, broken twills, and drills to other goods, including corduroys and drapery fabrics.

A scarcity of goods, however, is beginning to crop up here and there. In wide sateens, for example, where curtailments have been extremely heavy, shorts and seconds have become scarce, and jobbers are experiencing difficulty in finding any goods of this type.

With goods generally readily available at the mill level and demand remaining dormant, prices are soft. Nominally, prices of wide goods have not changed in recent weeks, but concessions are not difficult to obtain, a market check indicates, whenever a moderate-size order is in the market.

In effect, trading at present is being done on a confidential basis, with price likely to vary with each individual transaction. What one mill turns down, another, under more severe inventory pressure, may quickly accept. For this reason it is difficult at present to determine just where prices are on most wide fabrics, especially where any sizable business is involved.

INDUSTRIAL FABRICS

Drills	
59-inch 1.85 yd yd. 2.25-yd	\$0.335/.34 .285/.29
Ducks	
38-inch 1.78-yd. S.F. yd. 2.00-yd. D.F. 51.5-inch, 1.35-yd. S.F. yd.	nom. .30
Hose and belting	.63
Osnaburgs	
40-inch 2.11-yd yd. 3.65-yd.	.2275 .1525
Raincoat Fabrics	
Printcloth, 38½-in., 64-60, 5.35-yd. yd. 6.25-yd. Sheeting, 48-inch, 4.17-yd. 52-inch, 3.85-yd.	.1325 .1165 .20 .2275

Chafer Fabrics	
14.40-oz./sq. yd. Plyd.	.73
11.65-oz./sq. yd. S	.61
10.80-oz./sq. yd. S	.6575
Other Fabrics	
Headlining, 59-in., 1.65-yd.,	
2-ply vd.	.41
64-inch, 1.25-yd., 2-ply	.59
Sateens, 58-inch, 1.32-yd.	.52/.525
58-inch, 1.21-yd	.5675

Rayon

Total packaged production of rayon and acetate filament yarn during December was 56,200,000 pounds, consisting of 25,600,000 pounds of high-tenacity rayon yarn and 30,600,000 pounds of regular-tenacity rayon yarn. Production for 1957 totaled 714,300,000 pounds, consisting of 340,800,000 pounds of high-tenacity rayon yarn and 373,500,000 pounds of regular-tenacity rayon yarn. Production for 1956 had been: total, 749,600,000 pounds, including regular-tenacity yarn, 379,100,000 pounds, and high-tenacity rayon yarn, 370,500,000 pounds.

Filament yarn shipments to domestic consumers for December totaled 53,500,000 pounds, of which 25,200,000 pounds were high-tenacity rayon yarn and 28,300,000 pounds were regular-tenacity rayon yarn. Shipments for 1957 were: total, 684,700,000 pounds; high-tenacity, 324,000,000 pounds; regular-tenacity, 360,700,000 pounds. Shipments for 1956 had been: total, 725,400,000 pounds; high-tenacity, 357,500,000 pounds; regular-tenacity, 367,900,000 pounds.

Stocks on December 31 totaled 71,-800,000 pounds, made up of 16,200,000 pounds of high-tenacity rayon yarn and 55,600,000 pounds of regular-tenacity rayon yarn. End-of-1956 stocks had been: total, 62,200,000 pounds; high-tenacity rayon yarn, 13,200,000 pounds; regular - tenacity yarn, 49,000,000 pounds.

There were no reported price changes of rayon and filament yarns during the period under review.

RAYON PRICES

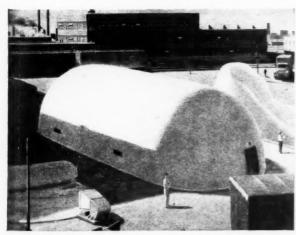
		Tie	re	3	į	= 2	ı	01	i	C	s					
1100/490/2 1650/908/2 2200/980/2							٠	,				\$0	.63	3 /		.725 .655
		T	ir	e		Y	a	ır	n	5						
High-Tenac	ity															
1100/ 490,	980													.50	1	.64
1100/ 490														.59	1	.63
1150/ 490,	980		,											.59		.63
1165/ 480														.59		.65
1230/ 490				,										.59		.63
1650/ 720														.55		.58
1650/ 980														.55		.58
1875/ 980														55		.58
2200/ 960														54		.57
2200/ 980													4	54	/	.57
2200/1466 4400/2934																.60
	con					•										.00
Super-High	1 en	ac	1	ty	1											
1650/ 720						,										.58
1900/ 720																.58

Marc

Vital radar equipment is housed in pressurized radomes of strong rubberized Wellington Sears fabric.



Structure is made by spraying concrete over balloon of rubberized nylon. Nylon base fabric supplied by Wellington Sears.



Welkote, nylon base fabric specifically engineered for vinyl and neoprene coating, is used in inflatable air structure.

Unusual housing projects rest firmly on fabric!

A shelter for our continental military defenses, a concrete storage building, an air-supported warehouse—all built with fabric. They represent still another group of new developments in industry made possible by the use of fabric in working combination with plastic, rubber, and other materials.

In housing projects of this kind—and in new irrigation tubing, fuel tanks, belts, hose and other products made through the coating, laminating, combining or frictioning of fabric—Wellington Sears figures importantly. With this experience, and over a century of background in industrial textiles, supplying a wide range of base fabrics for many purposes, Wellington Sears can help solve *your* fabric problem. Call on us, and for informative booklet, "Fabrics Plus," write Dept. H-3.

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FIRST In Fabrics For Industry

For Mechanical Goods, Coated Materials, Tires, Footwear and Other Rubber Products



WEST POINT MANUFACTURING C

Wellington Sears Company, 65 Worth Street, New York Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles Philadelphia • San Francisco • St. Louis

Synth	etic Ru	bers and	d Latices*		Philprene 1000, 1001, 1006	. 2475b
Monomers		Nitrex 26	12, 2614	\$0.46*	1018 1019 Plioflex 1006	. 265b
11-300	.265 .325	2013.	Polyethylene Type		Polysar S, S-50. S-X-371 S-1000, -1001, -1006, -1013. -1002, -1011	
Butadiene lb. Dow Styrene N99, H99 lb.	.27 .15 .205	Hypalon :	Polysulfide Types	.70	Synpol 1000, 1001, 1006, 1007, 1061 1002. 1012.	.241
RG. lb. Vinyltoluene lb. Hylene M. lb.	.17 .17 3.50 / \$5.0	-83	P-2, -3, -31, -32, -33.	1.25 *	1009	. 24751
T	1.90 / 3.4 1.10 / 2.6 .95 / 2.5	Type-A		.69*	Hot SBR Black Masterbatch Philprene 1100	.104
Isobutylene	1.00 / 2.5 .38 .25		Latices	1.00*	1104 S-1100	.1906
Mondur-C lbS lb. Multron R-2 lb.	1.00 / 1.2 1.05 .85 .54	Type M MX.	atex (dry wt.)	.85 a .70 a	Cold SBR Ameripol 1500, 1501, 1502	.241
Rohm & Haas ethyl acrylate lb. Glacial methacrylic acid lb.	.23 .34 / .3 .45 / .4	-5		.92 * .95 * .70 *	ASRC 1500, 1502. 1503. Copo 1500, 1502.	.2625 • .241 •
Methyl acrylatelb. Methacrylatelb.	.37 / .3		Silicone Types		1505 FR-S 1500, 1502 Naugapol 1503	.241 °
Shortstops		Silicone	ounded) \$2.25°/	4.10°	1504. Philprene 1500, 1502.	.2416
DDM	.75 / .8	pound	ded)	4.90° 3.65°	1503. Plioflex 1500, 1502	2414
Sharstop	.33 / .3	(Partly	compounded) 3.25b / pounded) 3.85b /	4 35b	Polysar Kryflex 200. SS-250.	.255 * .2875 *
Tecquinol	.825 / .8 .53	Union Car	rbide (compounds) 2.35b / 3.85b	3.20b 4.25b	SS-250 Krylene, NS. S-1500, -1501, -1502.	. 60
N	.41		Styrene Types†		Synpol 1500, 1502, 1551	.2416
Acrylic Types	.38 / .4		Hot SBR‡		Cold SBR Black Masterbatch Baytown 1600, 1601, 1602	.176*
Hycar 4021	1 . 35		1000, 1001, 1006, 1007	.241 ° .2435 °	Philprene 1600, 1601	.196
4501		1009 1011		.2475 ° .2550 °	S-1600, -1601, -1602	.1825*
Kel-F Elastomer		1013	0, 1001, 1004, 1006	. 2425 ° . 25 ° . 241 °	Ameripol 1703	.206 °
Isobutylene Type	s	1018		.270 ° .265 °	1707, 1708 1710, 1712	.191 .
Deenax		1009), 1001, 1004, 1006	.241 ° .2475 ° .26 °	ASRC 1703	.206 • .191 • .1885 •
268, 365	. 24	1012		.2425 •	FR-S 1703	.206 •
Hycar 2202 Polysar Butyl 100, 200, 300, 400	24.	0 1014	**********	.281 0	1705 1712 Philprene 1703	.1885*
101		· Naugapol	1016, 1019	.265b	1706	.2066 .2036 .1916
Neoprene		1021 1022		.30b	1712 Plioflex 1703, 1773	.18856
Neoprene Type AC, CG			* ; * ; * * * * * * * * * * * * * * * *	.285 в	1710, 1712 1778	.1885*
GN, GN-A, WXGRT, S		* Prices	are per pound carload or tank-	car dry	Polysar Krynol 651	.1885 •
W, WHV.		weight unt	ess otherwise specified.		S-1703. 1705, 1706.	.195*
WRT		▶ Minimu	ım freight allowed.		-1707 -17091712	.18*
Neoprene Latex 571, 842-A	37	\$SBR -S	prepaid. tyrene-butadiene rubber.		Synpol 1703	. 206b
572. 60, 601-A.	39		tadiene rubber. below are the new SBR type s	vnthetic	1711 1712	1945b
635 650	.42 / .53	rubbers an	d latices trade names and the chi their producers or distributors.			
735, 736		Americal	-Goodrich-Gulf Chemicals, Inc	c., 3135	Cold SBR Oil-Black Masterbatch Baytown 1801	.16*
950			Euclid Ave., Cleveland 15, —American Synthetic Rubber 500 Fifth Ave., New York 36	Corp.	Philprene 1803. S-1801.	.174b .1675a .165
Nitrile Types Butaprene NAA		Baytown	-United Rubber & Chemica	I Co.		
NF NL	504		Baytown, Tex. (producer); Carbon Co., Inc., Charles W. Va. (distributor).	ston 27,	FR-S 2000, 2001	.3325°
NXM Chemigum N1NS N3NS, N5		Butaprene, FR-S	-Firestone Tire & Rubber Co thetic Rubber Division, 381 Rd., Akron I, O.	o., Syn- Wilbeth	2002, 2003, 2004 2006 Naugatex 2000, 2001, 2006	.372 °
N6, N-6B, N7. Hycar 1001, 1041 1002, 1042, 1043, 1312	50	Соро	-Copolymer Rubber & Chemical P. O. Box 2595, Baton Rouge	Corp.,	2002	.30*
1012, 1042, 1043, 1312 1014 1072 1411	603	Naugapol, Naugater	-Naugatuck Chemical Division, States Rubber Co., Nau	United	Pliolite Latex 2000, 2001 2076. S-2000	.2825° .295° .2275•
1432	59	Philprene	Conn. —Phillips Chemical Co., Rubber	Chem-	2006	.215*
Paracril AJ. B, BJ, BJLT, BLT. C, CLT. CV D. 18-80.			icals Division, 318 Water St. 8, O.		Cold SBR Latices	.30•
C, CLT		Plioflex	-Goodyear Tire & Rubber Co., ical Division, Akron 16, O.		2102, 2105 FR-S 2105	.32 *
18-80. Polysar Krynac 800, 802, 803.		Pliolite Lat	ex—Goodyear Tire & Rubber Co., ical Division. Also distribu General Latex & Chemical	ted by	Naugatex 2101	.312
801		Polysar	666 Main St., Cambridge 39	, Mass.	X.767 Pliolite Latex 2101 2105. 2107.	.323 • .30 ° .325 •
Latices		//	—Polymer Corp., Ltd., Sarnia, Canada (producer); H. Mu & Co., Inc., 60 E. 42nd St York 17, N. Y. (distributor).	ehistein New	2107	.325° .305°
N-400, N-401.	54b	S-	York 17, N. Y. (distributor).	ic Rub.	2108. S-2101. -2105.	.225*
Chemigum 200. 235 CHS, 236 245 B, 245 CHS, 246, 247	406	3-	—Shell Chemical Corp., Syntheti ber Sales Division, 50 W. S New York 20, N. Y.	Oth St.	-2107	.32 •
Hycar 1512, 1552, 1562, 1577 1551, 1561, 1571	46 *	Synpol	Texas-U. S. Chemical Co. Neches, Tex. (producer); tuck Chemical (distributor).	. Port	Cold BR Latex5	
1852			tuck Chemical (distributor).		Pliolite Latex 2104	.325 *

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Litharge Sublimed Litharge Red Lead (95% 97% 98%) Sublimed Blue Lead



.2475b .26h .27h .265b .241e .255e .23a .2325s .241 .2435b .2425b .2475b

.194 .190 .185

.241 • .2625 • .241 • .261 • .2625 • .241 • .2625 • .241 • .2625 • .241 • .2625 • .241 • .2625

241 · 255 · 2875

1825

2035 .

191 * 1885 *

206 •

191b 1885b

206 ° 1885 ° 191 ° 1885 ° 191 ° 195 °

18 • 1775 • 206 •

9456

325

D

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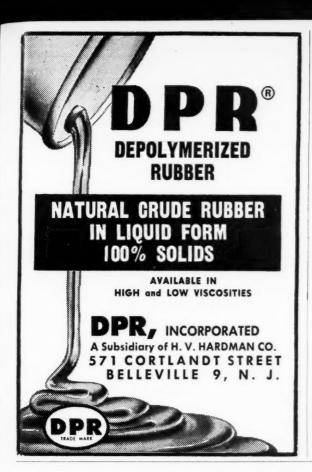


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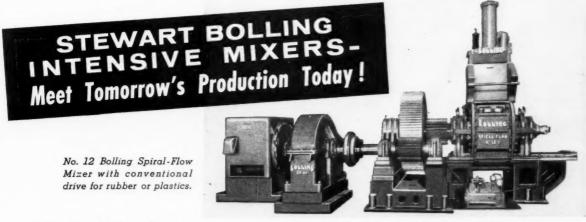
Compounding Ingredients*

Abrasives				Trimene	\$0.56 /	\$0.62
Pumicestone, powdered 1h	\$0.036	53/	\$0.065	Base	1.03 /	1.10
Rottenstone, domestic lb. Shelblast	.03		.04	Ultexlb.	1.00 /	1.10
Walnut Shell Gritston	50.00		160.00	Unads	.66 /	.73
Accelerator	s			Vulcacure NB	.45	1.05
A-1 (Thiocarbanilide)ton	.50	1	.57	NS	.85 / 2.45	.89
A-32	.66	1,	.80	Zenite	.52 /	.54
Accelerator 49	1.14	1	.60	Special	.53 /	.55
57, 62, 67, 77	1.04			Zetax	1.04	. 53
89	1.20			Accelerator-Activators	, Inorgani	С
108 1h	.91			Lime, hydratedton	21.96	
552. lb. 808. lb. 833. lb,	.66	1,	.68	Litharge, commllb. Eagle, sublimedlb.	.1575/	.18
Altax. 1b. Arazate. 1b.	1.17	1	1.19	National Lead, sublimedlb. Red lead, comml lb.	.1635/ .185/	.19
Bettenelb.	2.25	1	.71	Fagle	.1625	
Bismate	3.00	1	.32	National Leadlb. White lead, carbonatelb.	.19 /	.20
Butasan 1h	1.04	/	.32	Eaglelb. National Leadlb.	.175 /	.185
Butazate	1.04			Silicatelb. Eaglelb.	.1725/	.1825
Namatelb.	1.04	1	.50	National Leadlb.	.16 /	.17
Ziram	.89	1	1.04	Zinc oxide, comml.†lb.	.145 /	. 1925
Captax	1.95	1	. 46	Accelerator-Activator		
Cumate lb. Dibs lb. Diesterex N	1.45			Aktonelb. Baraklb.	.2125/	.2325
Diesterex N	.50	1	.57	Barak lb. Capital 170 lb. 171 lb. 700, 701 lb.	.20 / .1425/	.25
Dipac. lb. DOTG (diorthotolylguanidine) Cyanamid. lb.		,	65	700, 701	.175 /	.225
Du Pont	.64	1	.65	800	.175 /	.225
DPG (diphenylguanidine) Cyanamidlb.	.54		.55	801	.165 /	.19
Monsantolb. El-Sixtylb.	.52	1,	.58	802	.1925/	.2175
Ethasan	1.04	/	.04	D-B-A	1.95	
Ethazate	1.04			Groco 30lb.	.1425/	.1925
Ethyl Seleram lb. Thiurad lb.	3.00			35	.1475/	.1975
I hiram /h	1.04			Hyfac 400lb.	.1062/	.1375
Tuads lb. Tuex lb. Zimate lb.	1.04			430	.1612/ .1837/	.1925
Zimate	1.04	1	1.04	431 lb. Hystrene S-97 lb. T 45 lb.	.1863/	.2125
Ethylac #650	.93	1,	.95	T-70	.1738/	.20
Ziram lb. Ethylac #650 lb. Guantal lb. Hepteen lb. Base lb.	. 44	1	.50	R	.1138/	.14
Ledate	1.85			158	.1313/	.1575
MBT (2-mercaptobenzothiazole) American Cyanamidlb.	.44	1	.46	262	.1513/	.1775
Du Pont 1h	.42	1	.44	MODA	.295 /	.345
Naugatuck lb.	.55	1	.47	NA-22. lb. Oleic acid, comml. lb. Emersol 210 Elaine. lb. Groco 2, 4, 8, 18. lb.	1.00	.225
MBTS (mercaptobenzothiazy) disulfide)				Emersol 210 Elaine	.17 /	.22
Cyanamid	.54	1	.56	Plastone	1.85	.30
Du Pont. lb. Naugatuck. lb. W Cyanamidlb.	52 .59	1	.57	Ridactolb.	.25 /	.26
Merac #225	.75	1	1.05	Seedine	.1485/	.1703
Mertaxlb. Methasanlb.	1.04	/	.57	Stearic acid Emersol 120lb.	.19	
Methazate .lb. Methyl Thiram .lb. Tuads .lb.	1.04			150	.2225	
Tuads lb. Zimate lb.	1.14			Hydrogenated, rubber grd. Groco 56lb.		4505
Monex	1.14			Rufat 75	.1275/ .1062/	.1525
Mono-Thiurad. lb. 2-MT (2-mercaptothiazoline) Cynamid	1.14			Single pressed, commllb. Emersol 110lb.	.1475/	.1675
Du Pont	.88	1	.90	Groco 53lb.	.165 / .1525/	.19
NOBS No. 1	.76	1,	.78	Wilmar 253 lb. Double pressed, comml lb.	.1525/	.1725
O-X-A-F	.53	1	.58	Groco 54	.17 /	.195
O-X-A-F 1b. Pennac SDB 1b. Pentex 1b.	1.14	1	. 48	Wilmar 254 lb. Triple pressed, comml lb. Groco 55 lb.	.175 /	.195
Flour	2.17			Wilmar 255	.1875/	.2125
Pheney	.52	1	59	Sterene 60-R lb. Tonox lb. Vimbra lb.	.515 /	.1075
Pip-Pip	2.07			Vimbralb.	.32 /	1.08
Rotax lb. RZ-50, -50B lb.	1.00	1	.57	Vulklor	.17 /	.22
S. A. 52	1.14			Zinc stearate, comml lb.	.39 /	.44
S. A. 52 lb. 57, 62, 67, 77 lb. 66 lh. Santocure lb. NS lb. Saluros lb. 14 lb. Saluros lb. 15 lb. 16 lb. 16	1.04	,		Antioxidants		
NS	.76	1	.78	AC-1	.37 /	.86
Selenacs .lb. SPDX-GH .lb.	3.00	1	.74	-5	1.49 /	1.63
(-1.	1.20	1	1.34	Gel	.70 /	.72
Sulfads lb. Tellurac lb. Tepidone lb.	1.98	1	1.55	Gel. lb. H. P. lb. Hipar lb. Powder lb.	1.05 /	1.07
Tetrone A	1.91	1	.48	Powderlb.	.57 /	. 59
Thiofide 1b.	.88	1	1.25	* Prices, in general, are f.o.b. cates grade or quantity variation		
S	.64	1	.66	these prices is made. Spot prices	should be	btained
Thiotax	1.14	1	.46	from individual suppliers. † For trade names, see Color— ‡ At the request of the supplie	White, Zinc	Oxides.
S.	1.14			At the request of the supplier shown for carbon blacks are for	rs, the lower carloads	st prices in bags.
M	1.14			Prices for hopper carloads are low		

	\$0.88	1	.59
AgeResin	.57 .57 .57	1	50
Stalitelb.	.57		.59
		1	1.60
White	1.50	1	1.60
Akroflex C lb.	.81	1	.83 .78
Albasan	.69	1	.73
Allied AA 1144	. 23	1	.24
AA-1177lb.	.155	1	.165
Antioxidant 425 lb.	2 .47 1 .50 .23	1	2.50
2246lb.	1.50	1	1.53
Antisollb.	.15	1	.24
White lb. Akroflex C lb. CD lb. Albasan lb. Allied AA 1144 lb. AA-1177 lb. Amnox lb. Antioxidant 425 lb. 2246 lb. Antisun lb. Antisun lb. Antisun lb. Antox lb. Antox lb. Antox lb.	.55	1	.57
Aranoxlb.	3.25	1,	. 54
B I F -25	.55	1	.60
Burgess Antisun Waxlb.	.185		
B-X-A	1.49	1,	1.63
Copper Inhibiter X-872-L lb.	2.01	1	1.03
Antisun	.91	1///	1.16
Flectol H	.57	1	.59
Heliozone	.31	1	
Ionol	.91	1111	1.65
Microflake	1.55	/	.24
Neozone A	.20 1.55 .59	1	.61
C	.83	,	.57
Nevastain A	.51	1	.61
B	.51	1	. 70
Heliozone	.55	1	.60
Perflectol	.61	1	.68
		1,	.60
Polygard	.55	1	.60
Protector	.26	1	.31
Permalux	.60	1,	.62
Santonex 35	1.01	1	1.03
Santonex 35	.79 .52	1	81
B	.63	1,	.59
DD	.57	1	.59
DD	1.55	1,	1.57 1.62
Santowhite Crystals, Powder 10.	1.55 1.55 1.55	1	.59
L	1.25	1	1.32
Stabilite	.55	1,	.59
Llb.	60		.04
	.52	1,	.60
Powder	.41	1	. 55
Powder. 1b. Styphen I 1b. Sunolite #100 1b. #127 1b. Sunproof-713 1b.	.51	1	. 23
#127lb.		1,	.19
Improved	.25	1	.30
Improved. Ib. Jr. Ib. Tenamene 3 Ib. Thermoflex Ib. Ib		1,	.25
Tenamene 3	1.00	1	1.05
	.52	1	.57
Tysonite	.24	1,	.2475
Tysonite	.40	1	.80
Wing-Stay S	. 55	1	.67
Zalba	1.10	,	.54
Zemte			
		,	
Antiozonani		,	
Antiozonani	ts	,	1.26
Eastozone 30, 31	1 . 24 1 . 70	11.	1.26 1.72
Eastozone 30, 31 lb	1.24 1.70 1.24	1111	1.26 1.72 1.28
Eastozone 30, 31	1 . 24 1 . 70	11/1	1.26 1.72
Eastozone 30, 31 lb	1.24 1.70 1.24 1.24	1111	1.26 1.72 1.28
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic:	1.24 1.70 1.24 1.24		1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic:	1.24 1.70 1.24 1.24	,	1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic:	1.24 1.70 1.24 1.24 1.24	1,	1 . 26 1 . 72 1 . 28 1 . 26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics	1.24 1.70 1.24 1.24	,	1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb.	1 . 24 1 . 70 1 . 24 1 24 24 	1,	1 . 26 1 . 72 1 . 28 1 . 26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Zinc naphthenate, 8-10% lb. Blowing Age	1.24 1.70 1.24 1 24 24 24 .245 .22 .775 .245	1//	1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Zinc naphthenate, 8-10% lb. Blowing Age	1.24 1.70 1.24 1.24 1.24 2.24 2.27 2.275 2.245	1//	1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Age	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	1//	1.26 1.72 1.28 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Agent CP 1475 lc. Celogen lb.	1.24 1.70 1.24 1.24 1.24 2.24 775 2.25 775 2.25 1.95	11/1	1.26 1.72 1.28 1.26
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 2.24 775 2.25 775 2.25 1.95	1//	1.26 1.72 1.28 1.26 1.26
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 2.24 775 2.25 775 2.25 1.95	11/1 ///	1.26 1.72 1.28 1.26 30 .785 .30
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Blowing Agent CP 1475 lb. Carbonate lb. Solic maphthenate, 8-10% lb. Kempore R-125 lb. Opex 40 lb. Solium bicarbonate 100 lbs.	1.24 1.70 1.24 1.24 1.24 2.24 775 2.25 775 2.25 1.95	11/1	1.26 1.72 1.28 1.26 1.26
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Blowing Agent CP 1475 lb. Carbonate lb. Solic maphthenate, 8-10% lb. Kempore R-125 lb. Opex 40 lb. Solium bicarbonate 100 lbs.	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1 ///	1.26 1.72 1.28 1.26 30 .785 .30
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Blowing Agent CP 1475 lb. Carbonate lb. Solic maphthenate, 8-10% lb. Kempore R-125 lb. Opex 40 lb. Solium bicarbonate 100 lbs.	1.24 1.70 1.24 1 24 1 24 2.21 7.75 2.22 7.75 2.45 1.95 1.95 1.95 1.95 2.55 1.35 2.0 7.6	11/1 ///	1.26 1.72 1.28 1.26 30 .785 .30
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1 ///	1.26 1.72 1.28 1.26 30 .785 .30
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1 ///	1.26 1.72 1.28 1.26 30 .785 .30
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptic: Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Blowing Age Ammonium bicarbonate lb. Blowing Agent CP 1475 lb. Carbonate lb. Solium bicarbonate lb. NDX lb. Solium bicarbonate lb. NDX lb. Solium bicarbonate lb. Solium bicarbonate lb. NDX lb. Solium bicarbonate lb.	1.24 1.70 1.24 1 24 1 24 1 24 1 24 1 24 1 24 1 24 1	11/1/1/1	1.26 1.72 1.28 1.26 1.26 30 .785 .30 .09 .35 1.07
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Agent CP 1475 lc. Carbonate lb. So C lb. Kempore R-125 lb. Sodium bicarbonate 100 lbs. Carbonate, tech 100 lbs. Carbonate, tech 100 lbs. Carbonate, tech lb. NDX lb. NDX lb. So lb. Bonding Age	1.24 1.70 1.24 1 24 1 24 1 24 1 24 1 24 1 24 1 24 1	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorchol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Agent CP 1475 lc. Carbonate lb. So C lb. Kempore R-125 lb. Oopex 40 lb. Sodium bicarbonate 100 lbs. Carbonate, tech lol lb. Sodium bicarbonate lol lb. NDA lb. NDX lb. NDX lb. Soming Age Braze lb. Bonding Age Braze gal. Cover cement gal.	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorchol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Agent CP 1475 lc. Carbonate lb. So C lb. Kempore R-125 lb. Oopex 40 lb. Sodium bicarbonate 100 lbs. Carbonate, tech lol lb. Sodium bicarbonate lol lb. NDA lb. NDX lb. NDX lb. Soming Age Braze lb. Bonding Age Braze gal. Cover cement gal.	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52
Eastozone 30, 31 lb. 32 lb. Tenamene 30, 31 lb. UOP 88, 288 lb. Antiseptics Copper naphthenate, 6-8% lb. Pentachlorophenol lb. Resorcinol, technical lb. Zinc naphthenate, 8-10% lb. Blowing Age Ammonium bicarbonate lb. Carbonate lb. Blowing Agent CP 1475 lc. Carbonate lb. So C lb. Kempore R-125 lb. Oopex 40 lb. Sodium bicarbonate 100 lbs. Carbonate, tech loo lbs. Carbonate, tech loo lbs. Songe Paste lb. NDX lb. NDX lb. So lb. Bonding Age Braze gal. Cover cement gal.	1.24 1.70 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	1.26 1.72 1.28 1.26 30 .785 .30 .09 .35 1.07 3.85 5.52







Bolling builds 4 production sizes for a range of capacities: No. 3 (3400 cu. in.), No. 4 (5100 cu. in.), No. 10 (12160 cu. in.), No. 12 (16000 cu. in.). Also one production-laboratory model—No. 1B (1200 cu. in.). Also one laboratory model—No. 0 (275 cu. in.).

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Spiral-Flow Sides for the heating or cooling of geared drives, and other features.

stock, which give greater thermal efficiency... Split End Frames which permit rotor removal without completely dismantling ends of machine... Anti-Friction Bearings for optimum power, smoother running, and longer life. No end zone movement of rotors... Stewart Bolling production mixers offer other outstanding advantages for profitable operation; rotors with full circle end flanges; compound, dual or conventional geared drives, and other features.

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75

INTENSIVE MIXERS . MILLS . CALENDERS . REFINERS . CRACKERS HYDRAULIC PRESSES . PUMP UNITS . BALE SLITTERS . SPEED-REDUCERS

STEWART BOLLING & COMPANY, INC.

3192 EAST 65th STREET CLEVELAND 27, OHIO

G-E Silicone Paste SS-15lb.	84 52 /	\$5.10	Semi-Reinforcing Furn	ace—SRF		Red		
SS-64	3.65 /	6.75	Collocarb SRF		\$0 082 .085	Antimony trisulfidelb. R. M. P. No. 3lb.	\$0.285 /	\$0.315
-67 Primer	7.50 /	12.50	Continex SRF	.0575/	.115	Sulfur Freelb.	.78	
Hylene Mgal.	3.50 /	3.75	Furnex	.0525/	.115	Brilliant Toning Redlb. Cadmium red lithoponeslb.	1.95	3.77
M-50	6.50 /	16.00	Gastex	.045 /	.085	Cyanamid	1.72 /	1.90
Tie Cementgal.	2.00 /	5.60	Pelletex, NS	.0525/	.0875	Naphthol Red, Scarlet , lb.	.80	
Thixons. gal. Ty Ply, BN, Q, S, UP, 3640gal.	6.75 /	8.00 5.00	Rlb.	.0575/	.0925	Du Pont	1.47 /	1.90
RCgal.	3.75 /	3.00				Indian Red	.1275	.13
Brake Lining Sat	urants		Fine Thermal—	.0575		Lansco syntheticlb.	.1175	.145
BRT 3	.018 /	.0265	P-33	.0575		Mapico	.12	
Resinex L-Slb.	.0225/	.03	Medium Thermal-	-MT		Williams Redlb. Monsanto Maroon 113lb.	1.50	.1525
Carbon Black	s†		Sterling MTlb.	.04		61148	1.75	
Conductive Channe			Non-staining	.05		41	4.40	
Continental R-40	.23 /	.30	Stainlesslb.	.05		3501	1.15	
Kosmos/Dixie BBlb. Spheron Clb.	.23 /	.30				69191	3.38 1.10	
Voltexlb.	.18 /	.315	Colors			PRP-285lb.	1.27	
5. 8	FRC		Black			S-44	.0975	
Easy Processing Chan Collocarb EPC	.059 /	.099	Iron oxides, comml	.1235/	\$0.135	Stan-Tone D-2000lb.	1.25	
Continental AAlb.	.074 /	.1225	BK—Lanscolb. Williamslb.	.1275/	. 13	2110, 2120, 2121 lb.	, 98	
Komnobile 77/Dixiedensed 77lb.	.074 /	.1225	Lansco synthetic	10	.15	2200 <i>lb.</i> 2500 <i>lb.</i>	1.47	
Micronex W-6 lb. Spheron 19 lb.	0725/	.145	Mapico	.1475/	.45	2600	1.60	
Texas E	.0775/	.145	Superjet	.085 /	1.05	2700	1.75	
Witco #12lb. Wyex EPClb.	.074 /	.1225	Stan-lone	.45 /	1.20	2800	1.90 5.23 /	5.43
,	101107	1100	Vansul masterbatchib. Pastelb.	.60 /	.65	D-7105	2.26 /	2.46
Hard Processing Chan	nel-HPC		a mate	/		70 PCO5	3.23 / 5.52 /	3.65 5.72
Continental F	.074 /	.1225	Blue			D-7106	2.59 /	2.79 4.05
HX HPC. 1b. Kosmobile S/Dixiedensed	.074 /	.1225	Alkali Blue G, Rlb.	2.40 /	2 48	Vansul masterbatchlb.	.95 /	3.30
S lb. Micronex Mk. II lb.	.074 /	.1225	C. P. Iran Blueslb. Du Pontlb.	1.77 /	4.55	Venetianlb.	.04 /	.0675
Witco #6	.074 /	.1225	Filo	.28	1.45	White	27 /	. 285
M. C			Lansco ultramarines	1.55	.28	Antimony oxidelb. Burgess Icebergton	50.00 /	80.00
Arrow MPC	.0775/	.135	Monsanto Blue 7	3.45		Cryptone BT	.08	.11
Continental Alb.	.074 /	.1225	DPB-283lb.	1.93		Titanium pigments		
Kosmobile S-66/Dixiedensed S-66lb.	.0775/	.145	S-11	.80 /	1.05	Horse Head Anataselb. Rutilelb.	.255 /	.27
S-66	.0725/	.145	Stan-Tone Violet Hille	3.45		Rutile	.195 /	.205
Texas 109	.084	.1475	D-4000. lb. 4001. lb. 4002. lb.	3.00		Ti-Cal	.075 /	.0825
M /b. Witco /1 /b.	.0775/	.145	4900	1.97 /	2.15	Ti-Pure	.195 /	.225
	.0.4 /	, 1440	Vansul masterbatchlb.	.90 /	2.70	C 50 1h	.1225/	.1275
						DA 10 50 1h	23 /	24
Conductive Furnac			Brown			RA, -10, -50	.0825/	.24
Aromex CFlb.	.0875/	.145	Filo	.13		RA, -10, -50 lb. RC lbHT, -HTX lb. Unitane lb.		.0875 .085 .285
		.145 .15 .223	Filo	.1425/	.145	RA, -10, -50 lb. RC lbHT, -HTX lb. Unitane lb. Zopaque Anatase lb.	.0825/ .08 / .255 / .245 /	.0875 .085 .285 .27
Aromex CF lb. Vulcan C lb. SC lb.	.0875/ .105 / .18 /	. 15	Filo	.1425/ .125 .1575/	.16	RA, -10, -50.	.0825/ .08 / .255 / .245 / .205 /	.0875 .085 .285 .27 .29 .1825
Aromex CF	.0875/ .105 / .18 /	.15	Filo. lb. Iron oxides, comml. lb. Lansco synthetic lb. Mapico Brown lb. Sienna, burnt, comml lb. Williams lb.	.1425/ .125 .1575/ .0425/ .115 /	.16 .155 .1775	RA, -10, -50. bb. RC bbHT, -HTX Unitane Zopaque Anatase Rutile Zinc oxide, comml.	.0825/ .08 / .255 / .245 / .205 /	.0875 .085 .285 .27 .29 .1825 .165
Aromex CF lb. Vulcan C lb. SC lb. Fast Extruding Furna Arovel FEF lb. Continex FEF lb.	.0875/ .105 / .18 / ce—FEF .0675/ .06 /	.15 .223	Filo	.1425/ .125 .1575/ .0425/	.16 .155	RA, -10, -50. bb. RC bbHT, -HTX Unitane Zopaque Anatase Rutile Zinc oxide, comml.	.0825/ .08 / .255 / .245 / .205 / .145 / .1505/ .155 /	.0875 .085 .285 .27 .29 .1825 .165 .1705
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .0675/	.15 .223	Filo. lb. Iron oxides, comml. lb. Lansco synthetic. lb. Mapico Brown. lb. Sienna, burnt, comml. lb. Williams. lb. Raw, comml. lb. Williams. lb. Uniber, burnt, comml. lb. Umber, burnt, comml. lb.	.1425/ .125 .1575/ .0425/ .115 / .045 / .08 /	.16 .155 .1775 .1325 .1725	RA, -10, -50	.0825/ .08 / .255 / .245 / .205 / .145 / .1505/ .155 / .1588/	.0875 .085 .285 .27 .29 .1825 .165 .1705 .175
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .0675/ .0625/	.15 .223	Filo lb. Iron oxides, comml. lb. Lansco synthetic lb. Mapico Brown lb. Sienna, burnt, comml. lb. Williams lb. Raw, comml. lb. Williams lb. Williams lb. Williams lb. Williams lb. Williams lb. Williams lb. Raw, comml. lb. Raw, comml. lb. Sienna, lb. Raw, comml. lb.	.1425/ .125 .1575/ .0425/ .115 / .045 / .08 / .06 / .0725/ .0625/	.16 .155 .1775 .1325 .1725 .07 .085	RA, -10, -50 b. RC bb. HT, -HTX lb. Unitane lb. Zopaque Anatase lb. Rutile lb. Azo ZZZ-11, -44, -55 lb. 35% leaded lb. 50% leaded lb. Eagle AAA, lead free lb. 5% leaded lb.	.0825/ .08 / .255 / .245 / .205 / .145 / .1505/ .155 / .1588/	.0875 .085 .285 .27 .29 .1825 .165 .1705 .1788 .155 .155
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .0675/	.15 .223	Filo. lb. Iron oxides, comml. lb. Lansco synthetic. lb. Mapico Brown. lb. Sienna, burnt, comml. lb. Williams. lb. Raw. comml. lb. Williams lb.	.1425/ .125 .1575/ .0425/ .015 / .045 / .08 / .06 / .0725/ .0625/	.16 .155 .1775 .1325 .1725 .07	RA, -10, -50	.0825/ .08 / .205 / .245 / .205 / .145 / .1505/ .155 / .1588/ .145 / .155 / .159 /	.0875 .085 .285 .27 .29 .1825 .165 .1705 .175 .175 .155 .165
Aromex CF 1b.	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .06 / .0675/ .0625/	.15 .223 .125 .10 .10 .115 .125 .10	Filo. lb. Iron oxides, comml. lb. Lansco synthetic. lb. Mapico Brown lb. Sienna, burnt, comml. lb. Williams lb. Raw, comml. lb. Williams, lb. Williams lb. Williams lb. Williams lb. Raw, comml. lb. Williams lb. Raw, comml. lb. Williams lb. Williams, pure brown lb. Vandyke lb.	.1425/ .125 .1575/ .0425/ .115 / .045 / .06 / .0725/ .0625/ .07 / .155	.16 .155 .1775 .1325 .1725 .07 .085 .07	RA, -10, -50 b. RC bHT, -HTX lb. Unitane lb. Zopaque Anatase lb. Rutile lb. Zinc oxide, comml lb. 35% leaded lb. 35% leaded lb. 50% leaded lb. 55% leaded lb. 56% leaded lb. 56% leaded lb. 57% leaded lb. 58% leaded lb. 59% leaded lb. 59% leaded lb. Florence Green Seal lb. Red Seal lb.	.0825/ .08 / .255 / .245 / .205 / .145 / .1505/ .155 / .1588/ .145 / .155 / .155 / .155 / .157 / .157 /	.0875 .085 .285 .27 .29 .1825 .165 .1705 .175 .175 .155 .165 .165 .169 .1725
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .06 / .0675/ .0625/ .0625/	.15 .223 .125 .10 .10 .115 .125 .10	Filo. lb. Iron oxides, comml. lb. Lansco synthetic. lb. Mapico Brown. lb. Sienna, burnt, comml. lb. Williams. lb. Williams. lb. Williams. lb. Williams lb. Williams lb. Williams lb. Williams lb. Raw. comml. lb. Williams lb. Williams lb. Williams lb. Williams lb. Williams, pure brown. lb. Vandyke lb. Mapico Tan lb. Metallie Brown. lb. Metallie Brown. lb.	.1425/ .125 .1575/ .0425/ .115 / .045 / .06 / .0725/ .0625/ .07 / .155 .12 .2325/ .05 /	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825	RA, -10, -50 b. RC bHT, -HTX lb. Unitane lb. Zopaque Anatase lb. Rutile lb. Zinc oxide, comml. lb. Azo ZZZ-11, -44, -55 lb. 35% leaded lb. 35% leaded lb. 50% leaded lb. 55% leaded lb. 55% leaded lb. 55% leaded lb. 56% leaded lb. 57% leaded lb. Florence Green Seal lb. Red Seal lb. White Seal lb. Horsehead XX-4, -78, lb.	.0825/ .0825/ .255 / .245 / .205 / .145 / .1505/ .1558/ .145 / .145 / .1	.0875 .085 .285 .27 .29 .1825 .165 .1705 .175 .1788 .155 .165 .169 .1725 .1675 .1775
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .0625/ .0625/ FF .0675/	.15 .223 .125 .10 .10 .115 .125 .10	Filo	.1425/ .125 .1575/ .0425/ .115 / .045 / .06 / .0725/ .0625/ .0725/ .0625/ .0725/ .02	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825	RA, -10, -50	.0825/ .0825/ .255 / .245 / .205 / .145 / .1505/ .1558/ .145 / .145 / .155 / .1575 / .1625/ .1675 / .145 / .1675 / .1675 /	.0875 .085 .285 .27 .29 .1825 .165 .1755 .155 .155 .165 .169 .1725 .1775 .1755 .155
Aromex CF	.0875/ .105 / .18 / ce—FEF .0675/ .06 / .0675/ .0625/ .0625/ .0675/ .0675/	.15 .223 .125 .10 .10 .115 .125 .10	Filo. lb. Iron oxides, comml. lb. Lansco synthetic. lb. Mapico Brown. lb. Sienna, burnt, comml. lb. Williams. lb. Williams. lb. Williams. lb. Williams lb. Williams lb. Williams lb. Williams lb. Raw. comml. lb. Williams lb. Williams lb. Williams lb. Williams lb. Williams, pure brown. lb. Vandyke lb. Mapico Tan lb. Metallie Brown. lb. Metallie Brown. lb.	.1425/ .125 .1575/ .0425/ .115 / .045 / .06 / .0725/ .0625/ .07 / .155 .12 .2325/ .05 /	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825	RA, -10, -50	.0825/ .08 / .255 / .245 / .245 / .205 / .145 / .1505 / .155 / .155 / .155 / .145 / .155 / .1625 / .1675 / .145 / .145 / .1675 / .145 / .1675 / .155	.0875 .085 .285 .27 .29 .1825 .165 .1705 .175 .175 .155 .169 .1725 .1775 .155 .1775 .1775
Aromex CF	.0875/ .105 / .108 / .106 / .06 / .06 / .0675 / .0625 / .0625 / .0675 / .0675 / .0675 /	.15 .223 .125 .10 .10 .115 .125 .10	Filo	1425/ 125 1575/ 0425/ 115 / 045 / 06 / 0725/ 0625/ 07 / 155 12 2325/ 2.10 /	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .06 2.20	RA, -10, -50	.0825/ .0825/ .08 / .255 / .245 / .203 / .145 / .1505/ .1588/ .145 / .155 / .157 / .157 / .157 / .157 / .157 / .158 / .155 / .158 / .145 / .158 / .15	0.875 0.885 0.85 0.85 0.27 1.85 1.65 1.705 1.775 1.788 1.55 1.69 1.775 1
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0775 / .079 /	.15 .223 .125 .10 .10 .115 .125 .10	Filo	.1425/ .125 .1575/ .0425/ .115 / 0445 / .08 / .0725/ .0625/ .07 / .155 .2325/ .05 / .2.10 /	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825	RA, -10, -50 b. RC bHT, -HTX b. Unitane b. Zopaque Anatase b. Rutile b. Zinc oxide, comml. b. Azo ZZZ-11, -44, -55 b. Azo ZZZ-11, -44, -55 b. Soff leaded b. 35% leaded b. 55% leaded b. 55% leaded b. 55% leaded b. 55% leaded b. Horsened Green Seal b. Florence Green Seal b. White Seal b. White Seal b. Horsened XX-4, -78 b. Kadox-15, -17, -72, -515 b. 25 b. Lehigh, 35% leaded b. 50% leaded b. Florox-166, -167 b. St. Joe, lead free b. Florox-166, -167 b. St. Joe, lead free b. St. Joe, lead free b.	0825/ 0825/ 08 / 245 / 245 / 205 / 145 / 155 / 155 / 155 / 155 / 155 / 157 / 162 / 167 / 167 / 167 / 167 / 167 / 168 / 1	.0875 .085 .085 .27 .29 .1825 .1765 .1705 .1755 .155 .165 .1675 .1725 .1725 .1725 .1725 .1735 .1745 .1755 .1775 .1788 .1755 .1775 .1788
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0775 / .0775 /	.15 .223 .125 .10 .10 .115 .125 .10 .13 .105	Filo. lb.	.1425/ .125 .0425/ .0425/ .045 / .08 / .0625/ .0625/ .075 / .155 .12 .2325/ .05 / .2 .10 / .3025/ .42 / .42 / .42 / .43 / .44 / .45	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .06 2.20	RA, -10, -50	.0825/ .0825/ .08 / .255 / .245 / .203 / .145 / .1505/ .1588/ .145 / .155 / .157 / .157 / .157 / .157 / .157 / .158 / .155 / .158 / .145 / .158 / .15	0.875 0.885 0.85 0.85 0.27 1.85 1.65 1.705 1.775 1.788 1.55 1.69 1.775 1
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0779 / .0779 /	.15 .223 .125 .10 .10 .10 .125 .10 .13 .105	Filo	1425/ 125 125 125 1457/ 0425/ 045 / 06 / 0725/ 0625/ 07 155 12 2325/ 05 / 210 / 3925/ 42 / 3,50 / 5,30	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .06 2.20	RA, -10, -50	.0825/ .0825/ .08 / .255 / .245 / .203 / .145 / .1505/ .155 / .158 / .145 / .157 / .158 / .145 / .14	.0875 .0875 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .165 .1675 .1775
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .070 / .070 / .070 / .0725 / .0725 /	.15 .223 .125 .10 .10 .10 .115 .125 .10 .13 .105	Filo	1425/ 125 125 1575/ 0425/ 0425/ 0625/ 0725/ 0625/ 0725/ 0625/ 0725	.16 1.15 1.1775 1.1325 1.1725 1.007 1.085 1.07 1.0825 2.20 2.40 1.10 44 3.95 6.60 1.25	RA, -10, -50 b. RC bbHT, -HTX bb. Unitane bb. Zopaque Anatase bb. Rutile lb. Jinc oxide, comml bb. Azo ZZZ-11, -44, -55 bb. Azo ZZZ-11, -44, -55 bb. 50% leaded bb. 50% leaded bb. 50% leaded bb. 50% leaded bb. 5% leaded bb. 5% leaded bb. 5% leaded bb. Horsened MAA lb. Florence Green Seal lb. White Seal lb. White Seal lb. Horsened XX-4, -78 lb. Lehigh, 35% leaded lb. 50% leaded lb. Solve leaded lb. Lehigh, 35% leaded lb. Protox-166, -167 lb. St. Joe, lead free lb. Cryptone ZS lb. Cryptone ZS lb. Vellow Cadmium yellow lithopones. lb.	.0825/ .08 / .08 / .245 / .245 / .205 / .145 / .1505 / .155 / .155 / .157 / .158 / .157 / .257 / .157 / .157 / .257 / .157 / .157 / .257 / .25	.0875 .0875 .2885 .27 .29 .1825 .1705 .1705 .1705 .1705 .1705 .1505 .1655 .1675 .1715 .1725 .171
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .070 / .070 / .070 / .0725 / .0725 /	.15 .223 .125 .10 .10 .10 .115 .125 .10 .13 .105	Filo	.1425/ .125 .1575/ .0425/ .115 / .045/ .0625/ .07 / .155 .12 .2325/ .05 / .05 / .2.10 / .3925/ .42 / .3925/ .42 / .3925/ .530 / .4525 .110 / .120 / .120	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .266 .2.20 .50 .2.40 1.10 .444 3.95 6.60	RA, -10, -50	0825/ 08 / 245 / 245 / 203 / 145 / 1505/ 155 / 1588/ 145 / 145 / 155 / 1	0.875 .085 .285 .27 .29 .1825 .1705 .175 .175 .175 .155 .155 .165 .165 .165 .1775 .1
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .079 / .079 / .0725	.15 .223	Filo	1425/ 125 125 125 125/ 1045/ 1045/ 108 / 06 / 0725/ 0625/ 07 / 1555 12 2325/ 2.10 / 19 / 80 / 3925/ 42 / 5.30 / 5.30 / 1.10 / 1.	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC bb. HT, HTX bb. Unitane bb. Zopaque Anatase lb. Rutille lb. Simple lb. Zinc oxide, comml lb. Azo ZZZ-11, -44, -55 lb. 35% leaded lb. 35% leaded lb. 50% leaded lb. 5% leaded lb. 5% leaded lb. 5% leaded lb. 5% leaded lb. Horsenead XA-4, -78 lb. White Seal lb. White Seal lb. Horsenead XX-4, -78 lb. Sol% leaded lb. Solw leade	.0825/ .08 / .08 / .255 / .245 / .245 / .245 / .205 / .245 / .205 / .145 / .150 / .155 / .158 / .145 / .159 / .145 / .159 / .1625 / .158 / .145 / .1625 / .158 / .145 / .145 / .153 / .145 / .145 / .158 / .145 / .145 / .158 / .145 / .145 / .158 / .145 / .145 / .158 / .145 / .1	.0875 .0875 .2885 .27 .29 .1825 .1705 .1705 .1705 .1705 .1705 .1505 .1655 .1675 .1715 .1725 .171
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0775 / .079 / .0725 /	.15 ,223	Filo	1425/ 125 125 125 125/ 0425/ 045/ 06/ 07/ 155 12 2325/ 05/ 2.10/ 3.50/ 3	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .266 .2.20 .50 .2.40 1.10 .444 3.95 6.60	RA, -10, -50 b. RC	0825 0825	.0875 .085 .085 .285 .27 .29 .1825 .1705 .1775 .1788 .155 .155 .155 .1675 .177
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0725 / .0725 / .0725 / .0725 / .0925 / .10 / .0925 / .10 / .0925 /	.15 .223 .125 .10 .10 .115 .125 .10 .135 .125 .105 .135 .125 .1175 .125 .135 .125 .144	Filo	.1425/ .125 .125/ .125/ .0425/ .0425/ .0625/ .07/ .155 .12/ .2325/ .07/ .2.10/ .3025/ .42/ .3025/ .42/ .3025/ .42/ .42/ .3025/ .42/ .42/ .42/ .42/ .42/ .42/ .42/ .42	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50	.0825/ .08 / .08 / .08 / .245 / .245 / .205 / .145 / .1505 / .155 / .155 / .155 / .157 / .1675	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0725 / .0725 / .0725 / .0725 / .0925 / .0925 / .0925 / .0925 / .0925 / .0925 / .0925 / .0925 / .0925 /	.15 ,223	Filo		.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC b. HT, -HTX b. Unitane b. Zopaque Anatase b. Rutile b. Zinc oxide, comml b. Azo ZZZ-11, -44, -55 b. 20% leaded b. 35% leaded b. 55% leaded b. Horsene Green Seal b. Red Seal b. Horsehead XX-4, -78 b. Kadox-15, -17, -72, -515 b25 b. Lehigh, 35% leaded b. 50% leaded b. 50% leaded b. Cynthie Seal b. Sol leaded b. Sol lea	.0825/ .0825/ .08 / .08 / .08 / .245 / .145 / .145 / .155 / .155 / .155 / .145	.0875 .0875 .2885 .27 .29 .1825 .1705 .1705 .1705 .1718 .1555 .155 .1555 .1775
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .070 / .070 / .0725 / .072	.15 .223	Filo	.1425/ .125 .12575/ .0425/ .0425/ .0425/ .0625/ .07 / .1555 .12 .2325/ .2.10 / .3925/ .42 / .3925/ .42 / .3925/ .42 / .3925/ .42 / .40 /	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC b. HT, -HTX b. Unitane b. Zopaque Anatase b. Rutile b. Zopaque Anatase b. Rutile b. Zonaque Anatase b. Rutile b. Zonaque Anatase b. Rutile b. Zor b	.0825/ .0825/ .08 / .08 / .08 / .245 / .145 / .145 / .155 / .155 / .145 / .155 / .155 / .155 / .155 / .155 / .155 / .167 / .155 / .167 / .155	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .079 / .079 / .0725 / .0825 / .08	.15 .223	Filo	1425/ 125 125 125 125 125 125 125 125 125 125	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC	0825 0825	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .070 / .070 / .070 / .0725	.15 .223	Filo	1425/ 125 125 125 125 125 125 125 126 127 127 127 127 127 127 127 127 127 127	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC	0825 0825	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0775 / .0725 / .0825 /	.15 .223	Filo	1425/ 125 125 125 125 125 125 125 125 125 125	.16 1.15 1.1775 1.1325 1.725 1.005 1.0825 1.06 2.20 2.40 1.10 44 3.95 6.00 1.25 1.35 2.80	RA, -10, -50 b. RC	0825 0825	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0725 / .0825 /	.125 .10 .10 .10 .115 .125 .10 .135 .125 .1175 .125 .125 .1175 .125 .114 .135 .125 .114 .135 .125 .1175 .125 .135 .135 .125 .135 .135 .125 .135 .135 .135 .135 .135 .135 .135 .13	Filo	.1425/ .125 .12575/ .0425/ .0425/ .045 / .0625/ .07 / .155 .12 .2325/ .2.10 / .19 / .80 / .3925/ .42 / .3925/ .42 / .3925/ .10 / .10	.16 .155 .1775 .1325 .1728 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .44 3.95 6.60 1.25 1.35 2.80	RA, -10, -50 b. RC	.0825/ .0825/ .0825/ .085/ .085/ .245/ .145/ .145/ .155/ .158/ .145/ .155/ .158/ .145/ .1625/ .1575/ .145/ .1625/ .1675/	.0875 .0875 .0885 .285 .277 .29 .1825 .165 .1705 .1775 .1788 .155 .1675 .1717 .1725 .1717 .1718 .1717 .1718 .1717 .1718 .1717 .1718
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .079 / .0725 / .0825 /	.125 .10 .10 .115 .125 .10 .115 .125 .10 .115 .125 .10 .13 .105	Filo	1425/ 125 125 125 125 125 125 125 125 125 125	.16 1.15 1.1775 1.1325 1.725 1.005 1.0825 1.06 2.20 2.40 1.10 44 3.95 6.00 1.25 1.35 2.80	RA, -10, -50 b. RC	.0825/ .0825/ .0825/ .0825/ .0836/ .0845/ .1456/ .1456/ .1556/ .1556/ .1556/ .1556/ .1556/ .1675/	0.875 0.885 0.885 2.85 2.77 2.99 1.825 1.105 1.775 1.720 2.225 1.125 1.225 2.193 3.000
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .0725 / .0725 / .0725 / .0725 / .0825 /	.15 .223	Filo	.1425/ .1257 .1257 .0425/ .0425/ .045 / .06 / .0725/ .0625/ .07 / .155 .12 .2325/ .02 .10 / .19 / .80 / .3225/ .42 / .42 / .42 / .43 .50 / .43 .50 / .45 .20 .20 .20 .20 .20 .20 .20 .20 .20 .20	.16 1.15 1.1775 1.1325 1.725 1.005 1.0825 1.06 2.20 2.40 1.10 44 3.95 6.00 1.25 1.35 2.80	RA, -10, -50 b. RC	.0825/ .0825/ .0825/ .085/ .085/ .085/ .245/ .145/ .145/ .155/ .155/ .155/ .155/ .155/ .155/ .155/ .1625/ .1675/	0.875 0.8875 0.8875 0.8875 2.875 2.77 2.99 1.825 1.105 1.705 1
Aromex CF	.0875/ .105 / .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0775 / .0725 / .0725 / .0825 / .08	.125 .10 .10 .115 .125 .10 .115 .125 .10 .115 .125 .10 .13 .105	Filo	1425/ 125 125 125 125 125 125 125 125 125 125	.16 .155 .1775 .1325 .1725 .07 .085 .07 .0825 .235 .06 2.20 .50 2.40 1.10 .444 3.95 1.35 2.80 1.85	RA, -10, -50 b. RC	0825 0825	0.875 0.885 0.885 0.885 0.895
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .079 / .079 / .079 / .0725 / .0725 / .0875	.15 .223 .125 .10 .10 .10 .115 .125 .10 .10 .115 .125 .10 .13 .105 .125 .114 .15 .125 .114 .15 .13 .1625 .18 .165 .18 .165 .19 .09 .09	Filo	.1425/ .12575/ .0425/ .0425/ .0425/ .0625/ .077/ .1555 .12 .2325/ .2.10 / .19 / .80 / .3925/ .42 / .3925/ .42 / .3925/ .42 / .3925/ .42 / .3925/ .43 .50 / .45 .50 / .3925/ .45 .50 / .45	.16 .155 .1775 .1775 .1725 .1725 .07 .0825 .06 2.20 .50 2.40 .50 44 3.95 1.35 2.80 1.85	RA, -10, -50 b. RC	0825 0825	0.875 0.885 0.885 0.885 0.885 0.895
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0625 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0725 / .0725 / .0725 / .0725 / .0725 / .0875 / .0	.15 .223	Filo	.1425/ .1257 .1257 .0425/ .0425/ .045 / .06 / .0725/ .0625/ .07 / .155 .12 .2325/ .02 .10 / .19 / .80 / .3225/ .42 / .42 / .43 / .43 / .44 / .45	.16 1.155 1.1775 1.1325 1.1725 1.1725 1.07 0.0825 2.06 2.20 2.40 2.20 1.10 44 3.95 1.35 2.80 1.25 1.35 2.80	RA, -10, -50 b. RC	.0825/ .0825/ .08 // .08 // .08 // .08 // .08 // .08 // .08 // .08 // .08 // .08 // .08 // .08 // .145 // .147 // .158 // .148 // .148 // .148 // .158 // .148 // .158 // .147 // .158 // .158 // .147 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .253 // .253 // .253 // .253 // .253 // .254 // .253 // .253 // .254 // .255 // .254 // .255 // .254 // .255 // .255 // .255 // .255 // .255 // .255 // .255 // .255 // .255	0.0875 0.
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .0675 / .0625 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0775 / .0725 / .0725 / .0825 /	. 125 . 100 . 100 . 115 . 125 . 100 . 115 . 125 . 110 . 135 . 125 . 1175 . 125 . 125 . 1175 . 125 . 12	Filo	.1425/ .1257 .1257 .0425/ .0425/ .0625/ .077/ .155 .122.3325/ .2.10 / .199/ .3025/ .421/ .3025/ .421/ .3025/ .421/ .3025/ .421/ .3025/ .421/ .3025/	.16 1.155 1.1775 1.1725 1.1725 1.085 1.07 1.0825 2.20 2.40 1.10 4.44 3.950 6.950 1.25 1.35 2.80 1.85	RA, -10, -50 b. RC	.0825/ .0825/ .08 / .08 / .08 / .245 / .245 / .245 / .255 / .145 / .145 / .155 / .158 / .145 / .157 / .157 / .167 / .167 / .167 / .167 / .167 / .167 / .167 / .167 / .175	0.875 0.885 0.885 0.885 0.885 0.895
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0775 / .0775 / .0725 / .0725 / .0825 / .0825 / .0825 / .0825 / .0835 / .0836 / .0	. 125 . 100 . 100 . 115 . 125 . 100 . 115 . 125 . 110 . 135 . 125 . 1175 . 125 . 12	Filo	1425/ 125 125 125 125 125 125 125 125 125 125	.16 1.155 1.1775 1.1325 1.1725 1.0085 1.00825 2.20 2.40 1.10 4.44 3.956 2.20 1.25 1.35 2.80 1.85	RA, -10, -50 b. RC	.0825/ .0825/ .08 / .08	0.875 0.885 0.885 0.885 0.895
Aromex CF	.0875/ .105 / .18 / .06 / .06 / .06 / .06 / .0625 / .0675 / .0675 / .0675 / .0675 / .0775 / .0775 / .0725 / .0725 / .0725 / .0725 / .0725 / .0725 / .0725 / .0875 / .0	.15 .223	Filo	.1425/ .1257 .1257 .0425/ .0425/ .045 / .0625/ .07 / .155 .12 .2325/ .07 / .155 .12 .2325/ .2.10 / .19 / .80 / .3925/ .42 / .3925/ .42 / .3925/ .10 / .10 /	.16 1.155 1.1775 1.1325 1.1725 1.07 0.0825 0.07 0.0825 2.20 2.40 2.20 1.10 4.44 3.95 1.35 2.80 1.25 1.35 2.80 1.85	RA, -10, -50 b. RC	.0825/ .0825/ .08 / .08 / .08 / .245 / .245 / .245 / .255 / .145 / .145 / .155 / .158 / .145 / .157 / .157 / .167 / .167 / .167 / .167 / .167 / .167 / .167 / .167 / .175	0.875 0.8

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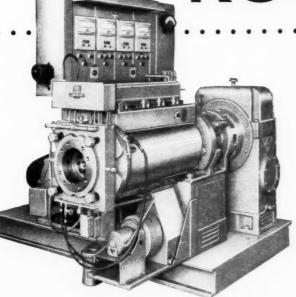


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Factice, Amberexlb.	.29 /	.36	Calcitelon	23.00		Pluronicslb.	.335 /	. 40
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OPD-101	.0775/	.0825	Yorkton	9.30		White	1.80	
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Sublac Resin PX-5lb. Sundex 53gal.	.215 /	.235	White	.75 /	1.25	55	.18	
85	.12		Paraffint RG and RGU Syn-			Iron Oxide, 60%	1.50	26
Synthetic 100	.41	.475	thetic Wax	1.00 /	2.00	P-33	.30 /	.35
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Agrashell flourton	50.00 /	74.00	Unidip	.15 /	.20	Telloy	3.00 1.14	
Albacar	55.00 /	75.00	Wax, Bees	.68 /	1.13	Vulcacure NB	. 45	
Barytes, floated, white	49.00 / 25.00	70.85	Montenlb.	.27		NSlb.	.75 /	1.05
						7B 7F 7M 16	×5 /	
No. 1	55.00 /	77.50	No. 118, colorsgal.	.86 /	1.41	NS	.85 /	1.30
No. 1	55.00 /	77.50 72.50 117.00	No. 118, colorsgal. Neutralgal. Van Waxgal.		1.41 1.31 1.50	G grouplb.	.40 /	1.30
No. 1 ton 2 ton Sparmite ton Blanc fixe ton	55.00 / 50.00 / 95.00 / 100.00 /	72.50 117.00 165.00	No. 118, colorsgal. Neutralgal. Van Waxgal.	.86 / .76 / 1.45 /	1.31	Vulcanizing, C group	.40 / .45 / .40 /	1.30 .90 1.00 .70
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 /	72.50 117.00 165.00 80.00	No. 118, colorsgal. Neutralgal.	.86 / .76 / 1.45 /	1.31	Vulcanizing, C group .lb. G group .lb. N group .lb. Vulcafoams .lb. Vulcanols .lb.	.40 / .45 / .40 /	1.30 .90 1.00
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 35.00 / 37.00 /	72.50 117.00 165.00 80.00 60.00 60.00	No. 118, colors	.86 / .76 / 1.45 / Ingredients	1.31 1.50	Vulcanizing, C group 1b. G group 1b. N group 1b. Vulcafoams 1b. Vulcanols 1b. Zetax 1b. Zimates, Butyl 1b.	.40 / .45 / .40 / .75 / .75 /	1.30 .90 1.00 .70
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess Iceberg ton Figment #20 ton #30. ton HC-75 ton -80 ton	55,00 / 50,00 / 95,00 / 100,00 / 50,00 / 35,00 /	72.50 117.00 165.00 80.00 60.00	No. 118, colors	.86 / .76 / 1.45 / Ingredients	1.31 1.50 8	Vulcanizing, C group. .lo. G group. .lb. N group. .lb. Vulcafoams. .lb. Vulcanols. .lb. Zetax. .lb.	.40 / .45 / .40 / .75 / .75	1.30 .90 1.00 .70
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess iceberg ton Pigment #20 ton #30 ton HC-75 ton -80 ton WP #1 ton	55.00 / 50.00 / 95.00 / 100.00 / 35.00 / 37.00 / 12.00 / 14.00 / 11.00 /	72.50 117.00 165.00 80.00 60.00 60.00 30.00	No. 118, colors	.86 / .76 / 1.45 / Ingredients .06 / .065 / .075 / 2.25	1.31 1.50 s .075 .08 .09	Vulcanizing, C group. 10. G group. 10. N group. 10. N group. 10. Vulcafoams. 10. Vulcanols. 10. Zetax. 10. Zimates, Butyl. 10. Ethyl, Methyl. 10. Zinc oxide. 10. Emulsions	.40 / .45 / .40 / .75 / .75 / .75 1.04 1.04	1.30 .90 1.00 .70
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess iceberg for Pigment #20 ton #30 ton HC-75 ton 80 ton WP #1 fon Camel-Carb ton -Tex ton	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 37.00 / 12.00 / 11.00 / 11.00 / 14.00 / 22.00	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00	No. 118, colors gal. Neutral gal. Van Wax gal. Latex Compounding Acintol D, DLR lb. FA \$1. lb. \$2. lb. Accelerator 552 lb. 1-117. 302 lb.	.86 / .76 / 1.45 / Ingredients .06 / .065 / .075 / 2.25 1.00 /	1.31 1.50 s .075 .08 .09	Vulcanizing, C group. 10. G group. 10. N group. 10. N group. 10. Vulcafoams. 10. Vulcanols. 10. Zetax. 10. Ethyl, Methyl. 10. Einc oxide 10. Emulsions AgeRite Stalite. 10. Borden Arcco A-25,	.40 / .45 / .40 / .75 / .75 / .75 / .40 .40 .40 .75	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 37.00 / 12.00 / 11.00 / 11.00 / 14.00 / 22.00	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00	No. 118, colors. gal. Neutral. gal. Van Wax. gal. Latex Compounding Acintol D, DLR. lb. FA ≠1. lb. ≠2. lb. Accelerator 552 lb114. lb144. lb307. lb.	.86 / .76 / .1.45 / .1	1.31 1.50 8 .075 .08 .09 1.15 .30 1.25	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Zetax. 16. Zimates, Butyl. 16. Zimates, Butyl. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16.	.40 / .45 / .40 / .75 / .75 1.04 .40 .75	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 37.00 / 12.00 / 11.00 / 11.00 / 14.00 / 22.00	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00	No. 118, colors	.86 / .76 / .1.45 / .1	1.31 1.50 8 .075 .08 .09 1.15 .30	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Einates, Butyl. 16. Zinc oxide. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16.	.40 / .40 / .40 / .75 / .75 1.04 1.04 .40 .75 .18 / .185 / .20 /	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 35.00 / 12.00 / 14.00 / 14.00 / 14.00 / 22.00 35.00 30.00 /	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00	No. 118, colors	.86 / .76 / .1.45 / .1	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 1.20	Vulcanizing, C group. 10. G group 10. N group 10. N group 10. Vulcafoams 10. Vulcanols 10. Zetax 10. Eithyl Methyl 10. Eithyl Methyl 10. Emulsions Age Rite Stalite 10. Borden Arcco A-25, A-26, 716-30 10. 655-40-R 10. 620-32B 10. 716-35 10.	.40 / .40 / .40 / .75 / .75 / .75 1.04 1.04 .40 .75	1.30 .90 1.00 .70 .80
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess Iceberg ton Figurent \$20 ton \$730 ton HC-75 ton WP \$1 ton Camel-Carb ton -Tex ton Cary \$200 ton Citrus seed meal bb. Oil. bb. Clays A. F. D. Filler ton	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 37.00 / 12.00 / 14.00 / 14.00 / 14.00 / 35.00 / 35.00 / 15.00 / 22.00 / 35.00 / 35	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .75 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 1.20 .72 .24	Vulcanizing, C group. 10. G group 10. N group 10. N group 10. Vulcafoams 10. Vulcanols 10. Zetax 10. Eithyl, Methyl 10. Eithyl, Methyl 10. Emulsions 10. AgeRite Stalite 10. Borden Arcco A-25, A-26, 716-30 10. 555-40-R 10. 620-32B 10. 716-33 10. 1041-21 10. Habuco Resin Nos. 502,	.40 / .40 / .40 / .40 / .75 / .104 .40 .75	1.30 .90 1.00 .70 .80
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess Iceberg ton Figment \$20 ton \$430 ton \$430 ton \$40	55,00 / 50,00 / 95,00 / 100,00 / 50,00 / 37,00 / 112,00 / 114,00 / 114,00 / 14,00 / 135,00 / 30,00 / 04,15 29,50 / 14,00	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00	No. 118, colors	.86 / .66 / .1.45 / .1	1.31 1.50 s .075 .08 .09 1.15 .30 1.25 .75 1.20 .72 .24 .14	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Zinc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-35. 16. 555-40-R. 16. 520-32B 16. 716-35. 16. Habuco Resin Nos. 502. 515, 523. 16.	40 / 45 / 40 / 40 / 40 / 40 / 40 / 75 1.04 1.04 40 .75 1.8 / 1.85 / .20 / .17 / .165 / .195 /	1.30 .90 1.00 .70 .80
No. 1 ton 2 ton Sparmite ton Blanc fixe ton Burgess Iceberg ton Figment \$20 ton \$430	55,00 / 50,00 / 95,00 / 95,00 / 95,00 / 100,00 / 55,00 / 37,00 / 12,00 / 11,00 / 11,00 / 14,00 / 22,00 / 35,00 / 30,00 / 25,50 / 14,00 / 50,00 / 25,50 / 525,50	72.50 117.00 165.00 80.00 60.00 30.00 32.00 16.00 55.00	No. 118, colors	.86 / .76 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 .75 1.20 .72 .24 .14	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcaroams. 16. Vulcanols. 16. Zetax. 16. Ethyl, Methyl. 16. Zinc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R 16. 620-32B 16. 716-35 16. Habuco Resin Nos. 502, 515, 523 16. 503. 16. 504, 526 16.	40 / 45 / 40 / 40 / 40 / 75 / 75 / 75 1.04 1.04 40 .75 .18 / .185 / .20 / .17 / .165 / .22 / .19 / .19 / .22 / .19 / .19 / .22 / .19 / .19 / .22	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 50.00 / 750.00 / 750.00 / 750.00 / 35.00 / 37.00 / 112.00 / 14.00 / 14.00 / 15.50 / 15.50 / 15.50 / 14.00 / 14.00 / 15.50 / 14.00 / 14.00 / 15.50 / 14.00 / 15.50 / 16.00 / 15.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16.50 / 16.00 / 16	72.50 117.00 165.00 80.00 60.00 30.00 32.00 16.00 55.00	No. 118, colors	.86 / .76 / .1.45 / .1	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 .72 1.20 .72 .24 .14 .075	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 503. 16. 504, 526. 16. 517. 16.	40 / 45 / 40 / 40 / 40 / 40 / 75 / 75 / 75 / 75 / 75 / 75 / 75 / 7	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 100.00 / 150.00 / 12.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.50 / 10.00 / 15.50 / 29.50 / 12.50 / 27.50 / 27.50 / 11.50	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00 55.00 36.00 55.00 36.00 33.50 36.00 33.50	No. 118, colors	.86 / .76 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .15	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 1.20 .72 .24 .14 .075 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Zimates, Butyl. 16. Zimo oxide. 16. Zimo oxide. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 503. 16. 504, 526. 16. 517. 16. 524. 16. Resin A-2. 16.	40 / 45 / 46 / 46 / 47 / 40 / 40 / 40 / 40 / 75 / 75 / 75 / 75 / 75 / 75 / 40 / 40 / 40 / 40 / 40 / 40 / 40 / 4	1.30 90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 95.00 / 95.00 / 100.00 / 50.00 / 35.00 / 35.00 / 37.00 / 11.00 / 11.00 / 11.00 / 14.00 / 22.00 / 35.00 / 30.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 22.50	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00 55.00 36.00 55.00 36.00 33.00 33.00 33.00 33.00 33.00	No. 118, colors	.86 / .76 / .1.45 / .1	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 .72 1.20 .72 .24 .14 .075	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcaroams. 16. Vulcanols. 16. Zetax. 16. Ethyl, Methyl. 16. Zinc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523 16. 504, 526 16. 517. 16. Sexion A-2 16. Resin A-2 16. Resin A-2 16. Resin A-2 16.	40 / 45 / 40 / 45 / 40 / 40 / 40 / 40 /	1.30 .90 1.00 .70 .80
No. 1	55.00 / 50.00 / 95.00 / 95.00 / 95.00 / 95.00 / 100.00 / 50.00 / 35.00 / 37.00 / 12.00 / 11.00 / 11.00 / 11.00 / 14.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 14.00 / 50.00 / 14.00 / 50.00 / 14.00 / 50.00 / 14.00 / 50.00 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 14.50 / 13.50	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 55 . 00 36 . 00 55 . 00 36 . 00 33 . 00 33 . 00 34 . 50 36 . 00 37 . 50 38 .	No. 118, colors	.86 / .76 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .255 / .145 / .145 / .255 / .145 / .145 / .250 / .145 / .145 / .250 / .145 / .250 / .145 / .250 / .145 / .250 / .145 / .250 / .145 / .250 / .145 / .250 / .145 / .250 / .250 / .145 / .250	1.31 1.50 5 .075 .08 .09 .09 1.15 .30 1.25 .75 1.20 .72 .24 .14 .075 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcaroams. 16. Vulcanols. 16. Zetax. 16. Ethyl, Methyl. 16. Zinc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R 16. 716-35. 16. 1041-21. 16. Sissing Nos. 502,	40 / 45 / 40 / 40 / 40 / 40 / 75 / 75 / 75 / 75 / 75 / 1.04 1.04 1.04 / 40 / 75 / 185 / 185 / 165 / 195 / 165 / 195 / 155 / 16 / 175 / 12 / 40	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .20 .225 .18 .18 .16 .25 .25
No. 1	55.00 / 50.00 / 95.00 / 95.00 / 95.00 / 95.00 / 100.00 / 55.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 11.00 / 14.00 / 15.50 / 14.00 / 22.550 / 27.50 / 14.50 / 14.50 / 14.50 / 14.50 / 11.50 / 11.550 / 11.550 / 11.550 / 11.55.50 /	72.50 117.00 165.00 80.00 60.00 60.00 30.00 32.00 16.00 55.00 36.00 55.00 36.00 33.00 33.00 33.00 33.00 33.00	No. 118, colors	.86 / .76 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .15	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 1.20 .24 .14 .075 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl. Methyl. 16. Zinc oxide. 16. Emulsions Age-Rite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 1041-21. 16. 1041-21. 16. 1041-21. 16. 503. 16. 504. 526. 16. 517. 16. 524. 16. Resin A-2. 16. P-370. 16. Freeze-Stabilizer 322. 16. 12116C. 16. Igepon T-43. 18.	40 / 45 / 40 / 40 / 40 / 40 / 75 / 75 / 75 / 75 / 75 / 75 / 75 / 7	1.30 .90 1.00 .80 .80 .19 .205 .21 .18 .175 .20 .225 .195 .16 .25 .22 .25 .21
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 50.00 / 50.00 / 50.00 / 50.00 / 50.00 / 50.00 / 50.00 / 12.00 / 11.00	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 35 . 00 55 . 00 36 . 00 55 . 00 38 . 50 38 .	No. 118, colors	.86 / .76 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .145 / .15	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 1.20 .24 .14 .075 .10 .18 3.48 .35 .70 .10 .10 .10 .10 .10 .10 .10 .10 .10 .1	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Zina coxide. 16. Zinc oxide. 16. Emulsions. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 504, 526 16. 517. 524. 16. Resin A-2. 16. P-370 16. Resin A-2. 16. Freeze-Stabilizer 322 16. Igepon T-43 16. Igepon T-44 Igen T-48. In India I	40 / 45 / 40 / 45 / 40 / 40 / 40 / 40 /	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .29 .21 .18 .25 .25 .25 .25 .25 .25
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 50.00 / 150.00 / 50.00 / 50.00 / 50.00 / 50.00 / 50.00 / 12.00 / 11.0	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 35 . 00 55 . 00 36 . 00 55 . 00 38 . 50 38 .	No. 118, colors	.86 / .76 / .1.45 /	1.31 1.50 5 0.075 .08 .09 1.15 .305 1.25 .75 1.20 .72 .24 .14 .075 .10 .18 3.45 .35 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Zina coxide 16. Emulsions. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21 16. Habuco Resin Nos. 502, 515, 523. 16. 504. 526. 16. 517. 16. Sept. 16. Freze-Stabilizer 322. 16. Freze-Stabilizer 322. 16. Igepon T-43 16. Igepon T-43 16. T-51 1673. 16. Ludox. 16.	40 / 45 / 40 / 45 / 40 / 47 / 40 / 40 / 40 / 40 / 40 / 40	1.30 .90 .90 .70 .80 .19 .205 .21 .18 .175 .195 .25 .25 .22 .22 .23 .24 .25 .25 .22 .22 .23 .22 .23 .23 .23 .23 .23 .23
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 37.00 / 12.00 / 11.00 / 11.00 / 14.00 / 13.50 / 22.00 / 35.00 / 35.00 / 35.00 / 25.50 / 27.50 / 14.00 / 25.50 / 27.50 / 14.50 / 27.50 / 14.50 / 11.5	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 35 . 00 55 . 00 36 . 00 55 . 00 38 . 50 38 .	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .77 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 .72 .24 .14 .075 .10 .18 3.45 .35 .70 .10 .15 .15 .10 .15 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Einaction 16. Einaction 16. Enulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, S15, 523. 16. 504, 526. 16. 504, 526. 16. 517. 16. 524. 16. P-370. 16. P-370. 16. Freeze-Stabilizer 322. 16. 12116C. 16. Igepon T-43. 16. T-51. 16. T-51. 16. T-73. 16. Ludox. 16. Marmix. 16. Marmix. 16.	40 / 45 / 40 / 45 / 40 / 40 / 40 / 40 /	1.30 .90 .90 .70 .80 .19 .205 .21 .18 .175 .195 .25 .25 .25 .25 .25 .495 .495 .481 .195
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 37.00 / 12.00 / 11.00 / 14.00 / 11.00 / 14.00 / 14.00 / 14.00 / 14.00 / 15.50 / 14.50 / 13.5	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 35 . 00 55 . 00 36 . 00 55 . 00 38 . 50 38 .	No. 118, colors	.86 / .76 /	1.31 1.50 5 0.075 .08 .09 1.15 .305 1.25 .75 1.20 .72 .24 .14 .075 .10 .18 3.45 .35 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Eine Salette. 16. Enulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 503. 16. 504, 526. 16. 517. 16. 524. 16. Freze-Stabilizer 322. 16. 12116C. 16	40 / 45 / 40 / 45 / 40 / 40 / 40 / 40 /	1.30 .90 .90 .70 .80 .19 .205 .21 .18 .175 .195 .25 .25 .22 .22 .23 .24 .25 .25 .22 .22 .23 .22 .23 .23 .23 .23 .23 .23
No. 1	55.00 / 95.00 / 95.00 / 95.00 / 95.00 / 95.00 / 100.00 / 50.00 / 35.00 / 37.00 / 12.00 / 11.00 / 11.00 / 11.00 / 14.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 14.00 / 22.00 / 14.00 / 25.50 / 22.50 / 22.50 / 22.50 / 25.50 / 14.50 / 13.50	72.50 117.00 165.00 80.00 60.00 60.00 60.00 32.00 16.00 55.00 36.00 55.00 28.50 36.00 33.3.00 33.3.00 33.3.00 35.25 55.50	No. 118, colors. gal. Neutral. gal. Van Wax gal. Latex Compounding Acintol D, DLR. lb. FA ≠1. lb. ≠2. lb. Accelerator 552 lb. J-117, -302 lb307 lb307 lb311 lb. Acrosol, dry types lb. Liquid types lb. Alcogum AA-16, MA-16 lb. AK-12, PA-10 lb. AN-6 lb. AN-6 lb. AN-6 lb. AN-6 lb. Antifoam J-114 lb. P-242 lb. Antifoam J-114 lb139, -293 lb186 lb186 lb186 lb186 lb297 lb. Anti Webbing Agent J-183 lb297 lb. Aquablak B. lb. G. lb. G. lb. M. Acuballak B. lb. G. lb. M. lb. M. lb. M. lb. M. lb. M. lb. M. lb. Aquarex D. lb. M. lb. Aquarex D. lb. M. lb. Aquarex D. lb. Aquarex D. lb. B. Lag. Lag. Lag. Lag. Lag. Lag. Lag. Lag.	.86 / .76 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Einco scide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 504, 526. 16. 517. 16. Sey 16. Sey 16. Sey 16. Freeze-Stabilizer 322. 16. Regin A-2 16. Freeze-Stabilizer 322. 16. T-51. 16. Marmix 16. Micronex, colloidal. 16. Monsanto Blue 4685 WD. 16.	40 / 45 / 40 / 45 / 40 / 40 / 40 / 75 / 51 04 1.04 .40 .75 .18 / 1.85 / .20 / 1.76 / 1.65 / 1.55 / 1.55 / 1.25 / 1	1.30 .90 .90 .70 .80 .19 .205 .21 .18 .175 .195 .25 .25 .25 .25 .25 .495 .495 .481 .195
No. 1	55.00 / 50.00 / 95.00 / 95.00 / 95.00 / 100.00 / 55.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 11.00 / 11.00 / 14.00 / 15.50 / 14.00 / 22.550 / 27.50 / 14.50 / 11.55 / 11.5	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 32 . 00 32 . 00 35 . 00 55 . 00 36 . 00 55 . 00 38 . 50 38 .	No. 118, colors	.86 / .77 / .78 / .78 / .78 / .78 / .78 / .78 / .78 / .78 / .78 / .79 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Einc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 555-40-R. 16. 503-2B 16. 716-35 16. Habuco Resin Nos. 502, 515, 523 16. 504, 526 16. 517. 16. Espon T-43 16. Resin A-2 16. Resin A-2 16. Freeze-Stabilizer 322 16. X-210 12116C 16. Igepon T-43 16. Igepon T-43 16. Ludox 16. Marmix 16. Marmix 16. Merac. 16. Micronex, colloidal 16. Micronex, colloidal 16. Micronex, colloidal 16. Green 4884 WD 16. Red 127 16.	40 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 40	1.30 .90 1.00 .80 .19 .205 .21 .18 .175 .20 .225 .195 .16 .25 .22 .25 .22 .25 .25 .25 .21 .25 .25 .25 .21 .25 .25 .25 .25 .25 .25 .25 .25 .25 .25
No. 1	55.00 / 50.00 / 95.00 / 10.00 / 10.00 / 12.00 / 12.00 / 11.00	72.50 117.00 165.00 80.00 60.00 60.00 60.00 32.00 16.00 55.00 36.00 55.00 28.50 36.00 33.3.00 33.3.00 33.3.00 35.25 55.50	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .065 / .075 / .2.25 / .1.00 / .15 / .1.10 / .15 / .1.2 / .75 / .1.10 / .20 / .1.15 / .1.10 / .20 / .1.1675 / .3.25 / .24 / .55 / .1.10 / .1.50 / .75 / .1.10 / .1.50 / .75 / .1.2 / .77 / .9975 / .12 / .78 / .12 / .78 / .12 / .78 / .3.33	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcafoams. 16. Zetax. 16. Ethyl. Methyl. 16. Zinc oxide. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 504, 526. 16. 504, 526. 16. 517. 16. 524. 16. Freeze-Stabilizer 322. 16. Freeze-Stabilizer 322. 16. Ligepon T-43. 16. T-51. 16. Ligepon T-43. 16. T-51. 16. Ligepon T-43. 16. Marmix. 16. Marmix. 16. Monsanto Blue 4685 WD. 16. Green 4884 WD. 16. Red 127. OPD 101. 16. Red 127.	40 / 40 / 40 / 40 / 40 / 40 / 40 / 40 /	1.30 .90 1.00 .80 .80 .19 .205 .21 .18 .175 .20 .225 .195 .18 .25 .22 .25 .22 .25 .21 .25 .25 .21 .25 .25 .21 .25 .25 .25 .25 .25 .25 .25 .25 .25 .25
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 37.00 / 11.00	72.50 117.00 165.00 89.00 60.00 60.00 60.00 60.00 31.00 32.00 35.00 35.00 36.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00	No. 118, colors	.86 / .76 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Environment 16. Zinates, Butyl. 16. Einlyl, Methyl. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523. 16. 503. 16. 504, 526. 16. 517. 16. 524 16. Freze-Stabilizer 322. 16. P-370 16. Freze-Stabilizer 322. 16. Freze-Stabilizer 322. 16. Little 16	40 / 45 / 40 / 45 / 40 / 45 / 40 / 40 /	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .225 .195 .195 .225 .25 .25 .22 .285 .495 .195 .295 .495 .495 .72 .72 .72 .72 .72 .73 .73 .73 .73 .73 .73 .73 .73 .73 .73
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 11.00 / 13.50 / 14.00 / 25.50 / 27.50 / 14.00 / 25.50 / 27.50 / 14.50 / 11.5	72.50 117.00 165.00 80.00 60.00 60.00 60.00 32.00 16.00 55.00 36.00 55.00 28.50 36.00 33.3.00 33.3.00 33.3.00 35.25 55.50	No. 118, colors	.86 / .77 / .77 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Einlyl. Methyl. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523. 16. 504, 526. 16. 517. 16. 524 16. Nesin A-2 16. P-370 16. P-370 16. Freeze-Stabilizer 322. 16. P-370 16. Freeze-Stabilizer 322. 16. Lilfe 16. Freeze-Stabilizer 322. 16. Lilfe 16. Freeze-Stabilizer 322. 16. Lilfe 16. Marmix 16. Marmix 16. Monsanto Blue 4685 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Red 127 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16.	40 / 40 / 40 / 40 / 40 / 40 / 40 / 40 /	1.30 .90 1.00 .80 .80 .19 .205 .21 .18 .175 .20 .225 .195 .18 .25 .22 .25 .22 .25 .21 .25 .25 .21 .25 .25 .21 .25 .25 .25 .25 .25 .25 .25 .25 .25 .25
No. 1	55.00 / 95.00 / 100.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 11.00 / 14.00 / 11.00 / 14.00 / 22.00 35.00 / 25.50 / 27.50 / 14.00 / 25.50 / 27.50 / 14.00 / 14.00 / 15.50 / 11.00 / 11.50	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 31 . 00 32 . 00 35 . 50 36 . 50 37 . 50 38 . 50 39 . 50 31 . 50 31 . 50	No. 118, colors	.86 / .77 / .77 / .77 / .77 / .77 / .77 / .77 / .77 / .77 / .77 / .78 / .71 / .77 / .78 / .78 / .71 / .77 / .78 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 .72 .24 .14 .075 .10 1.8 3.45 .35 .70 1.60 2.15 1.53 .90 40 .10 .10 .10 .10 .10 .10 .10 .10 .10 .1	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcanols. 16. Zetax. 16. Ethyl. Methyl. 16. Einlyl. Methyl. 16. Zinc oxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523. 16. 504, 526. 16. 517. 16. 524 16. Nesin A-2 16. P-370 16. P-370 16. Freeze-Stabilizer 322. 16. P-370 16. Freeze-Stabilizer 322. 16. Lilfe 16. Freeze-Stabilizer 322. 16. Lilfe 16. Freeze-Stabilizer 322. 16. Lilfe 16. Marmix 16. Marmix 16. Monsanto Blue 4685 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Red 127 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16. Polyvinyl methyl ether. 16.	40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 75 / 75 / 75 / 75 / 75 / 104 / 40 / 40 / 40 / 40 / 40 / 40 / 4	1.30 .90 1.00 .80 .80 .19 .205 .21 .18 .175 .225 .195 .18 .16 .25 .25 .25 .25 .25 .25 .25 .27 .20 .205 .21 .205 .205 .205 .205 .205 .205 .205 .205
No. 1	55.00 / 95.00 / 10.00	72.50 117.00 165.00 80.00 60.00 60.00 60.00 60.00 60.00 32.00 32.00 355.00 28.50 36.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .77 / .76 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .120 .121 .24 .14 .075 .10 .18 3.45 .35 .70 .10 .15 .15 .10 .15 .10 .10 .15 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcaroams. 16. Vulcaroams. 16. Vulcaroams. 16. Zetax. 16. Ethyl, Methyl. 16. Zinc oxide 16. Ethyl, Methyl. 16. Zinc oxide 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R 16. 620-32B 16. 716-35. 16. 1041-21. 16. 555-40-R 16. 503. 16. 504, 526 16. 517. 16. 524 16. September 24. Fereign A-2 16. V-210 16. Freeze-Stabilizer 322 16. Lillox. 16. Lillox. 16. Marmix 16. Lidox. 16. Marmix 16. Micronex, colloidal. 16. Morsanto Blue 4665 WD 16. Green 4884 WD 16	40 / 45 / 40 / 45 / 40 / 45 / 40 / 40 /	1.30 .90 1.00 .80 .19 .205 .21 .18 .175 .20 .225 .195 .18 .16 .25 .25 .25 .25 .25 .495 .195 .195 .195 .205 .21 .225 .225 .225 .225 .225 .225 .225
No. 1	55.00 / 95.00 / 95.00 / 95.00 / 95.00 / 95.00 / 100.00 / 50.00 / 35.00 / 35.00 / 37.00 / 11.50 / 11.50	72.50 117.00 165.00 80.00 60.00 80.00 60.00 30.00 32.00 16.00 55.00 28.50 36.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 33.00 35.25	No. 118, colors	.86 / .76 /	1.31 1.50 5 0.075 .08 .09 1.15 .30 1.25 .75 .72 .24 .14 .075 .10 .125 .155 1.55 1.55 1.55 1.55 1.55 1.55	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. N group. 16. Vulcanolas. 16. Zetax. 16. Zimates, Butyl. 16. Zimates, 16.	40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 475 / 51 .04 1.04 40 .75 .18 / 175 / 17	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .195 .18 .16 .25 .25 .25 .25 .22 .285 .495 .495 .495 .495 .48 1.05 .072
No. 1	55.00 / 50.00 / 95.00 / 10.00 / 10.00 / 10.00 / 12.00 / 11.00	72.50 117.00 165.00 80.00 60.00 60.00 60.00 312.00 16.00 55.00 35.00 35.00 35.00 35.25 35.50 31.50 32.00 32.00 35.25	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .065 / .065 / .075 / .75	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 .72 .24 .14 .075 .10 .18 3.45 .35 .70 .15 .15 .10 .15 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Einco scide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 503. 16. 504, 526 16. 517. 16. 517. 16. Emulsions 16. Freeze-Stabilizer 322 16. Resin A-2 16. Freeze-Stabilizer 322 16. T-51 16. T-51 16. T-51 16. T-51 16. Green 4884 WD 16. Marmix 16. Micronex, colloidal. 16. Micronex, c	40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 45 / 40 / 40	1.30 90 1.00 .70 .80 .19 .205 .21 .18 .175 .195 .195 .225 .225 .222 .35 .225 .495 .495 .495 .495 .495 .495 .495 .49
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 14.00 / 14.00 / 14.00 / 14.50 / 35.0	72 . 50 117 . 00 165 . 00 80 . 00 60 . 00 60 . 00 60 . 00 30 . 00 31 . 00 32 . 00 35 . 00 36 . 00 37 . 00 38 . 00	No. 118, colors	.86 / .76 / .76 / .76 / .76 / .76 / .76 / .76 / .065 / .075 / .75	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 2.24 .14 .075 .10 1.8 3.45 .70 2.15 1.55 1.55 1.55 1.25 .10 40 .10 .10 .10 .10 .10 .10 .10 .10 .10 .1	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcafoams. 16. Zetax. 16. Ethyl. Methyl. 16. Eincoxide. 16. Eincoxide. 16. Emulsions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523. 16. 503. 16. 504, 526. 16. 517. 16. 524 18. Resin A-2 16. P-370 16. Freeze-Stabilizer 322. 16. Freeze-Stabilizer 322. 16. Freeze-Stabilizer 322. 16. Ludox. 16. Marmix. 16. Marmix. 16. Marmix. 16. Monsanto Blue 4685 WD 16. Green 4884 WD 16. Green 4884 WD 16. Red 127 16. OPD 101 Green 4884 WD 16. Red 127 16. OPD 101 Bolivier 170. 16. Polyvinyl methyl ether 16. Resin V. 16. Rosinger 190. 16. Sellogen Gel 16. Sequestrene AA 16.	40 / 45 / 40 / 45 / 40 / 45 / 40 / 40 /	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .225 .195 .18 .16 .25 .25 .25 .25 .25 .275 .285 .495 .195 .195 .195 .25 .25 .275 .275 .275 .275 .275 .275
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 14.00 / 14.00 / 14.00 / 14.50 / 33.00 / 33.00 / 35.0	72.50 117.00 165.00 80.00 60.00 60.00 60.00 312.00 16.00 55.00 35.00 35.00 35.00 35.25 35.50 31.50 32.00 32.00 35.25	No. 118, colors	.86 / .76 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 2.24 .14 .075 .10 1.8 3.45 .70 2.15 1.55 1.55 1.55 1.25 .10 40 .10 .10 .10 .10 .10 .10 .10 .10 .10 .1	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcafoams. 16. Vulcafoams. 16. Zetax. 16. Envil. Methyl. 16. Einyl. Methyl. 16. Einyl. Methyl. 16. Einyl. Methyl. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523 16. 503. 16. 504, 526 16. 517. 16. 524 16. Freze-Stabilizer 322 16. P-370 16. Freze-Stabilizer 322 16. Freze-Stabilizer 322 16. Ludox. 16. Marmix. 16. Marmix. 16. Marmix. 16. Marmix. 16. Marmix. 16. Monsanto Blue 4685 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Red 127 16. OPD 101 16. Picco Latex Plasticizer A12. Borloyinyl methyl ether 16. Polyvinyl methyl ether 16. Resin V. 16. Rosil V. 16. Rosil V. 16. Rosil V. 16. Sellogen Gel 16. Sellogen Gel 16. Sellogen Gel 16. Setsit 45. 16. Estist 45. 16. Estist 45. 16. Estist 45.	40 / 45 / 40 / 45 / 46 / 40 / 45 / 40 / 45 / 40 / 40 / 40 / 40	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .225 .195 .18 .16 .25 .25 .25 .25 .25 .27 .285 .48 1.05 .072
No. 1	55.00 / 50.00 / 95.00 / 10.00 / 10.00 / 12.00 / 11.00 / 12.00 / 11.00 / 11.00 / 12.00 / 11.00 / 11.00 / 12.00 / 11.00 / 12.00 / 11.00 / 12.00 / 11.00 / 12.00 / 11.00 / 12.00 / 12.00 / 13.50 / 14.50 / 13.50 / 11.00 / 12.50 / 14.50 / 13.50 / 11.00 / 12.50 / 14.50 / 13.50 / 13.50 / 14.50 / 13.50 / 13.50 / 14.50 / 13.50 / 13.50 / 14.50 / 12.50 / 13.50 / 14.50 / 13.50 / 13.50 / 14.50 / 13.50 / 13.50 / 14.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50 / 13.50	72.50 117.00 165.00 80.00 60.00 60.00 60.00 312.00 16.00 55.00 35.00 35.00 35.00 35.25 35.50 31.50 32.00 32.00 35.25	No. 118, colors	.86 / .76 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 .75 .120 .72 .24 .14 .14 .075 .10 1.83 .45 .35 .70 .10 .155 .155 .10 .10 .10 .10 .10 .10 .10 .10 .10 .10	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcafoams. 16. Vulcafoams. 16. Vulcafoams. 16. Zetax. 16. Envil. Methyl. 16. Einyl. Methyl. 16. Einyl. Methyl. 16. Einyl. Methyl. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B. 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502. 515. 523 16. 503. 16. 504, 526 16. 517. 16. 524 16. Freze-Stabilizer 322 16. P-370 16. Freze-Stabilizer 322 16. Freze-Stabilizer 322 16. Ludox. 16. Marmix. 16. Marmix. 16. Marmix. 16. Marmix. 16. Marmix. 16. Monsanto Blue 4685 WD 16. Green 4884 WD 16. Green 4884 WD 16. Green 4884 WD 16. Red 127 16. OPD 101 16. Picco Latex Plasticizer A12. Borloyinyl methyl ether 16. Polyvinyl methyl ether 16. Resin V. 16. Rosil V. 16. Rosil V. 16. Rosil V. 16. Sellogen Gel 16. Sellogen Gel 16. Sellogen Gel 16. Setsit 45. 16. Estist 45. 16. Estist 45. 16. Estist 45.	40 / 40 / 45 / 46 / 46 / 46 / 46 / 47 / 47 / 47 / 47	1.30 90 1.00 .70 .80 .19 .205 .21 .18 .175 .20 .225 .195 .18 .16 .25 .22 .22 .285 .495 .481 .072 .072
No. 1	55.00 / 50.00 / 95.00 / 100.00 / 95.00 / 100.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 35.00 / 12.00 / 11.00 / 14.00 / 14.00 / 14.00 / 14.50 / 33.00 / 33.00 / 35.0	72.50 117.00 165.00 80.00 60.00 60.00 60.00 312.00 16.00 55.00 35.00 35.00 35.00 35.25 35.50 31.50 32.00 32.00 35.25	No. 118, colors	.86 / .76 /	1.31 1.50 5 .075 .08 .09 1.15 .30 1.25 1.20 2.24 .14 .075 .10 1.8 3.45 .70 2.15 1.55 1.55 1.55 1.25 .10 40 .10 .10 .10 .10 .10 .10 .10 .10 .10 .1	Vulcanizing, C group. 16. G group. 16. N group. 16. N group. 16. Vulcanolas. 16. Vulcanolas. 16. Zetax. 16. Ethyl, Methyl. 16. Einisions AgeRite Stalite. 16. Borden Arcco A-25, A-26, 716-30. 16. 555-40-R. 16. 620-32B 16. 716-35. 16. 1041-21. 16. Habuco Resin Nos. 502, 515, 523. 16. 504, 526 16. 517. 16. Series A-2 16. Freez-Stabilizer 322 16. X-210. 16. Freez-Stabilizer 322 16. X-210. 16. Igepon T-43 16. Igepon T-43 16. Igenon	40 / 45 / 40 / 45 / 46 / 40 / 45 / 40 / 45 / 40 / 40 / 40 / 40	1.30 .90 1.00 .70 .80 .19 .205 .21 .18 .175 .225 .195 .18 .16 .25 .25 .25 .25 .25 .27 .285 .48 1.05 .072

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SITUATIONS OPEN

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SITUATIONS OPEN (Cont'd)

TECHNICAL SALES REPRESENTATIVE

If you're a graduate chemist or chemical engineer — with proven industrial sales experience in the rubber industry and a working knowledge of compounding, processing and product application and interested in an excellent base salary, plus additional worthwhile benefits, a major synthetic rubber manufacturer offers an unusual opportunity for growth and advancement in a new Technical Sales organization now being staffed.

To investigate the opportunity, in the strictest confidence, please forward a résumé detailing academic training, business experience, age and other pertinent data; and a snapshot of yourself.

Box No. 2169, RUBBER WORLD

RUBBER CHEMIST

Position and salary depending on experience. Heel and sole experience desirable, but not essential. Age (20-55 years). Details on request. Dr. Stuart B. Row, V. P., O'SULLIVAN RUBBER CORPORATION, Box 603, Winchester, Virginia.

RUBBER CHEMIST WANTED. OUR OPERATIONS REQUIRE a graduate chemist when the compounding natural rubber, GR-S, and Neoprene. Must have a working knowledge of heel and sole compounding and development. Good opportunity for qualified person. Please reply with resume which will be treated confidentially. GRO-CORD RUBBER COMPANY, Box 419. Lima, Ohio.

CHEMIST—EXCELLENT OPPORTUNITY FOR MAN WITH several years' latex experience. Can use man with experience in any branch of latex work. MORNINGSTAR-PAISLEY, INC., 630 West 51st Street, New York 19, N. Y.

WANTED. AGENT TO REPRESENT PLASTIC INJECTION molding company for custom molding. Must have excellent contacts with toy and novelty manufacturers, automotive, appliances, or other industries who are large users of plastic products. Give full information first letter. Address Box No. 2152, care of RUBBER WORLD.

"INVESTIGATE SOUTH CAROLINA"

- Rubber Adhesive Chemist or Chemical Engineer
 Urethane Foam Chemist or Engineer
 Research Director—Ph.D. or equivalent

- Rubber Mill-Plant Manager Rubber Mill-Plant Engineer-Mechanical

Write or call today. CONTINENTAL TAPES, Cayce, S. C.

REPRESENTATIVE FOR NEW ENGLAND TERRITORY. SEMIretired, executive acquainted and familiar with plastic and rubber field. Full or part-time basis. Strictly on substantial commission basis. Preferman with investment capital. Established firm now in similar line. Address Box No. 2168, care of Rubber World.

SALES & TECHNICAL SERVICE: Require experience in all phases of latex adhesives and coating compounds and applications. Key position, unlimited opportunity. Midwest territory. Write fully Box No. 2166, care of RUBBER WORLD

IMPORTANT BRITISH POST

General Manager required by large English public company which is one of the leading manufacturers in the plastics and rubber industries. Successful applicant would be required to live in Midland Counties of England and would be responsible to the Board of Directors for the direction of all technical, administrative and commercial activities of large unit situated in that area. Candidates must possess good technical and commercial qualifications and must have extensive experience in general management at top level.

Applications for this post, which is superannuable (i.e., leads to a pension), will be treated in complete confidence. Must include fullest personal and commercial particulars, including nature of appointments held, the names of at least two references, date available to commence and an indication of salary required. Initial interviews will be arranged in the U.S.A. Apply Box 2165, Care of RUBBER WORLD.

WANTED:

RIIBBER CHEMIST OR TECHNICIAN

Immediate opening for a competent man having rubber experience, preferably molded goods. Write stating qualifications to:

GRISWOLD RUBBER CO., INC.

Moosup, Conn.

MAJOR PUBLISHING OPPORTUNITY

A long-established, top-rated industrial business publication is looking for a key man. Sales engineer background and/or advertising related experience in the rubber or chemical industries preferred. Compensation open depending upon man. Must have capacity for adding major management responsibilities to sales ability. Write in complete confidence to:

Box No. 2161, c/o RUBBER WORLD.

SITUATIONS WANTED

PLANT MANAGER WITH 25 YEARS' EXPERIENCE WANTS position with aggressive organization. Wide knowledge mechanicals, extrusions, tires, in development, production, costs. Chemical Engineer. Address replies to Box No. 3153, care of RUBBER WORLD.

PERMANENT OPPORTUNITY DESIRED — TECHNICAL, sales, or ?? Resident Southern Cal. 20 years' excellent varied experience as chemist, mostly mechanical rubber, some sales, business, etc. Prefer large potential to immediate high income. Address Box No. 2154, care of RUBBER WORLD.

							*0.615 /	\$0.64
Stablex P	\$0.35 /	\$0.50	Califlux G. P	\$0.015 / .0475/	\$0.0225 .0575	Naugatucklb. PX-438lb.	,015 /	.64
Surfactol 13	1.50 /	2.50	T-Tlb.	.019 /	.0295	Rubber Corp. of America lb. Drapex 3.2	.61 / .40 / .30 /	.54
			510, 550	.195 /	.235	-A20 (DOP), A30 (DIOP).1b.	.305 /	.335
Mold Lubrica	.06 /	.075	Harchem lb. Chlorowax 40 lb.	1625/	.1825	-A54	.61 /	.63
A-C Polyethylenelb. Alipal CO-433lb.	.30 /	.37	70	.185 /	.245	-F21	.395 /	.47
CO-436lb.	.22 /	.41	C.rco light gal. Circosol-2XH gal.	.17		-F41	.48 /	.51 .035
Aquarex Compoundslb. Carbowax 200, 300, 400lb.	.21 /	.94	Contogumslb.	.0875/	.111	Dymerex Resin	.135 /	.1475
1500	.255 /	.2825	Cumar Resins	.065 /	.17	Endor	.65	.455
6000	.35 /	.36	Daraxlb. DBP (dibutyl phthalate),	.32 -/	.3475	Ethox	.135 /	.165 .1425
Colite Concentrate gal.	1.50	1.15	Darex	.30 /	.133	Wyandotte	.44 /	.46
D-Tak Dip #10 gal. DC Mold Release Fluidlb. Compound 4, 7lb.	3.14 / 5.13 /	4.75 6.50	Eastmanlb. Harwick Std. Chem. Colb.	.325 /	.335	3 GO	.325 /	.355
Emulsion 7	1.59 /	2.07	Hatcolb. Monsantolb.	.30 /	.33	10-A	.27 /	.30
200 Fluidlb.	3.14 /	4.75	Naugatucklb. Ohio-Apexlb.	.30 /	.33	810, 810X, 10-10, 10-10X .lb. TOF. A-26lb.	.305 /	.335
FT Wax 200 lb.	.265 /	.42	PX-104lb.	.30 /	.33	Flexricin P-4	.3475/	.3625
300	.295 /	.45	Rubber Corp. of America.lb. Sherwin-Williamslb.	.30 /	.33	P-8	.3475/ .335 /	.3625 .35
concentrated. gal. Igepals	1.25	1.63	DBS (dibutylsebacate) commllb.	.66 /	.69	Fortex	.125 /	.145
1-45	.145 /	.68	Eastmanlb. Hatcolb.	.68 /	.71 .685	Naphthenic Neutrals gal. Process oil, light lb.	.125 /	.215
-51lb.	.125 /	.285 .495	Monoplex	.665 /	.675	Medium	.0375/	.0475
Lubrex	10.00 /	12.05	PX-404lb. DCP (dicaprylphthalate),	.665 /	. 69	Galex W-100	.1525/	.1775
Lustermold	.41 3.50	14.00	comml	.295 /	.325	Glisowax B	.0975/	.11
Mold Paste	.25		Monoplexlb.	.30 /	.315	Harflex	1.25 /	1.335
Monopole Oillb. Monten Waxlb.	.16	040	DDA (didecyladipate) Cabflexlb. Good-rite GP-236lb.	.425 /	.455	50	.60 /	.69 .675
Para Lube	.046 /	048	DDP (didecylphthalate)	.40 /	.55	60	.65	1.01
thetic Wax	.15	.22	Cabflex	.305 /	.335	120, 150	.28 /	.375
8416, 8417lb. 8429lb.	.35 /	.42	Hatco lb. Defoamer X-3 lb.	.305 /	. 435	180	.27 /	.36
Pluronics	.335 /	44	DIBA (diisobutyladipate) Cabflexlb.	.4325/	4625	280lb.	.42 /	.51
600	1.22 /	58 1.40	Darex	.4325/	.4625	390	.315 /	.41
1000	.94 /	1.06	Ohio-Apex	.41 /	.445	HB-20	.15 /	.17
RA-1, -2, -3gal.	2.25 /	3.00	Monsantolb.	.425 /	. 455	HSC-13	.0225/	.0375
Rubber Glo	1.22 /	1.76	DIDP (diisodecylphthalate) Darex	.32 /	.35	.39	.22 /	. 29
Soap, Hawkeye	1.35 /	1.45	Monsanto	.305 /	.335	Hycar 1312	.13 /	.225
Stoner's 700 seriesgal.	1.20 /	1.25	PX-120	.305 /	.335	Kapsol	.26 /	.27
800 series	1.26 /	1.70	Diethylene glycol, commllb. Wyandottelb.	.1525/	.1825	N	.18 /	.19
A Seriesgal. Ucon 50-HB Serieslb.	1.80 /	4.50	Dinopol IDO	.285 /	.32	105	.3325	
Ulco	1.95	3.00	Cabflexlb.	.425 /	.455	106	.525	
			Naugatuck	.425 /	.455	110	.24	.325
Odorants			Rubber Corp. of America.lb. DIOP (diisooctylphthalate),			-90	.315 /	.435
Alamasks	2.95 /	6.50 3.55	comml	.305 /	.335	-140	.46 /	.485
Curodex 19	4.75 / 5.75	5.05	Darex	.32 /	.35	-220	.33 /	.365
198 lb. Ethavan lb.	5.75	7.35	Hatco	.305 /	.335	Kronisol	.33 /	.365
Ethavan lb. Latex Perfume #7 lb. Neutroleum Gamma lb.	4 00 3 60		Naugatuck	.305 /	.335	LX-685, -125, -135lb. Marvinol plasticizerslb.	.125 /	.135 .8825
Rodo	4.00 / 2.60	5.50	PX-108	.305 /	.335	Methox	.385 /	.41
Vanillin, Monsantolb.	3.00 /	3.15	Sherwin-Williamslb.	.32 /	.34	S-71	.45 /	.475
Plasticizers and So	fteners		DIOS (diisooctylsebacate), comml	.61 /	.64	Natac	1.05	.13
Acintol R	.065 /	.07	Rubber Corp. of America.lb. DIOZ (diisooctylazelate)	.61 /	.84	Nevillac	.31 /	.85 .205
BCA	.43 /	.435	Cabflex	.48 /	.51	Neville R Resins. lb. Nevinol. lb. No. 1-D heavy oil lb.	.24	. 200
ODY	325	. 465	Dispersing Oil No. 10	.06 /	.0625	NP-10	.50 /	.53
711	345		DNODP (di-n-octyl-n-decyl phthalate), Monsanto lb.	.345 /	.375	ODA (octyldecyladipate) Cabflex	.425 /	.455
744	10 /	.12	DOA (dioctyladipate), commllb.	.425 /	.455	ODP (octyldecylphthalate)	.40 /	.55
Baker AA Oil lb. Crystal O Oil lb. Processed oils lb.	.21 /	.255	Cabflex	.425 /	.455	Cabflex lb. Good-rite GP-265 lb.	.305 /	.335
Bardol, 639	.215 /	235	Good-rite GP-233lb. Hatcolb.	.40 /	.55	Hatco	.305 /	. 335
Benzoflex 2-45	.26 /	.29	Monsantolb.	.425 /	. 455	Ohopex Q-10	.28 /	.315
9-88	.555 7	.30	Naugatuck	.425 /	.455	Orthonitro benzophenol, comml	.13 /	. 15
22	.025 /	.175	DOP (dioctylphthalate).			Monganto lb.	.13 /	.15
30	.0125/	021	comml	.305 /	.335	Palmalene	.185 /	.225
BRH 2 1h	.0213/	.0351	Darex	.32 /	.35	Panarez Resins	.10 /	.2125
BRS 700. 1b. BRT 7. 1b. BRV. 1b.	.03 /	.031	Good-rite GP-261lb. Hatcolb.	.305 /	.44	No. 2016	.165 /	.24
Bunarex Liquid	.0425/	.0555	Monsanto	.305 /	.335	Para Lube	.1075/	.2125
Bunnatol G. S	.40 /	.505	Ohio-Apex	.28 /	.315	Resins	.04 /	.045
Butac lb. Butyl stearate, comml lb. Binney & Smith lb.	.255	.26	PX-138	.305 /	.335	Al-111	.32 /	.3475 .3275
Hardesty lb. Ohio-Apex lb.	.23 /	.26	Sherwin-Williamslb. DOS (dioctylsebacate),	.305 /	.335	G-25	.76 .4825/	.77 .51
Cabflex HS-10	.44 /	.47	comml	61 /	.64	-50	.39 /	.4175
G. P	.0125/	.02	Hatco	.01 /	. 635	-60lb.	.325 /	.35
TT	.017 /	.02	45 Monoplex	10. 782 .01	/ .635	*05	,	

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SITUATIONS WANTED (Cont'd)

RUBBER TECHNOLOGIST, EXPERIENCED IN COMPOUNDing, product development and supervision, laboratory control. Presently employed as Chief Chemist by small company manufacturing drug sundries, hospital rubber sheeting. Responsible position with progre company desired. Address Box No. 2155, care of Rubber World.

CHEMIST-PLANT SUP'T, 15 YRS. DIVERSIFIED EXPERI-nce in adhesives and cements. Can formulate latex emulsions, natural ence in adhesives and cements. Can formulate latex emulsions, natural and synthetic rubbers, has milling and calender operations experience. Qualified in development, production, and management. Desires top-level position or growth. Will relocate. Address Box No. 2156, care of RUBBER WORLD

RUBBER TECHNOLOGIST DESIRES RESPONSIBLE POSI-tion. Seventeen years' experience in overall operations. Background in-cludes compounding, research, development, production, cost estimation, management, etc. Address Box No. 2157, care of RUBBER WORLD.

TECHNICAL SALES AND/OR SERVICE TO THE RUBBER and allied industries. Over sixteen years' experience in development, compounding, manufacturing, as well as technical service and sales. Address Box No. 2158, care of Rubber World.

PRODUCTION CONTROL SCHEDULING, 30 YRS.' EXP. TIRES, surgical, housewares. Experience in expediting, materials forecasts, training, supervision, production, IBM controls, by-product and salvage control. Self-starter, gets things done. Résumé on request. Address Box No. 2162, care of RUBBER WORLD.

PLANT MANAGER, TECHNICAL DIRECTOR, B.Sc., 25 YEARS' experience compounding, processing, plant operations. Location immaterial. Available immediately. Address Box No. 2167, care of RUBBER WORLD.

SUPERVISOR FOR RUBBER PLANT. EXPERIENCED IN MOLD shop supervision, tooling lay-out, mold design. Currently Employed—Rubber field, Mold and Tooling Maintainance and experimental, College Background, 18 years machine shop experience. Will relocate. Address Box No. 2170, care of Rubber World.

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WHEN YOU THINK OF RUBBER MACHINERY Think of

Think of
JOHNSON MACHINERY
Largest Stock in the U. S.
Extruders. Tablet Presses, Injection Molders, Hydraulic Presses, Scrap
Cutters, Calenders, Mills, Blenders, Mixers, Ovens, Hydraulic Pumps,
Laminating and Molding Equipment. See Us First. JUHNSON MACHINERY CO., 679 Frelinghuysen Ave., Dept. RW, Newark, N. J. BIgelow

HYDRAULIC PRESSES, 2500-TON DOWNSTROKE 54" x 102".

375-ton upstroke 28" x 28", 300-ton upstroke 41" x 30", 300-ton upstroke 22" x 35", 300-ton multi-opening 40" x 40" platens. 250-ton French Oil upstroke 38" x 28", 170-ton upstroke 24" x 24", 150-ton Elmes upstroke 36" x 25", 140- ton 36" x 36" platens. 300-ton Stokes Transfer Molding Press. New & Used Lab, 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders, & sizes up to 84". Baker-Perkins & Day Heavy-Duty Jack. Mixers up to 200 gals. Hydraulic Pumps & Accumulators. Rotary Cutters. Colton 5½ T, 4T & 3DT Preform Machines Motor Driven. Other sizes in Single Punch & Rotary Pre-Form Machines. Banbury Mixers, Crushers. Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107—8th Street, Brooklyn 15, New York. STerling 8-1944. York. STerling 8-1944.

FARREL-BIRMINGHAM MIDGET BANBURY MIXER. PER-iect condition, never used. WM. E. HOOPER & SONS COMPANY, 3500 Parkdale Avenue, Baltimore 11. Maryland.

SURPLUS EQUIPMENT

6-Blaw Knox 6' x 40' Horizontal Vulcanizers with quick opening doors, 250# working pressure, ASME National Board Stamped.

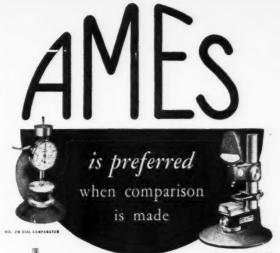
1-Thropp 6" x 12" Two Roll Rubber Mill. 1-Gelbco 6" x 13" Two Roll Rubber Mill. 2-Royle #1/2 Extruders, complete.

2-Baker Perkins Stainless Steel Double Arm Jacketed Vacuum Mixers with Masticator Blades, with compression cover, complete. 21/4 and 10 gal. capacity.

1 Banbury Midget Mixer with 2 HP gear motor.

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640. lb. Pepton 22. lb. 65. lb. 65-B. lb.	.42 .83 / 1.23 / .83 /	.86 1.26 .86	4	.025 / .03 / .0475/	.026 .031 .0565 .0805	R	127.50 / 163.50 60.00 / 96.00
Pieco Resins lb.	.11	.195	BWH-1 lb. Dipolymer Oil gal, Dispersing Oil No. 10 lb.	.16 /	.18	Retarders	
Aromatic Plasticizers lb.	.05 /	. 23	G. B. Olls gat.	.113 /	.0625	Benzoic acid TBAO-2lb.	.44
Liquid Resin D-165 (Y)lb. (Z-3)lb.	.06 /	.075	Heavy Resin Oillb. LX-572gal.	.0225/	.0375	E-S-E-N	.62 / 66
S. O. S	.08 /	.095	-759	.1375	.33	R-17 Resin	.57
Piccolastic Resins lb.	.1855/	.055	-869gal. -871gal.	.33 /	.43	J	.62 / .64 .39 / .41
Piccolyte Resins lb. Piccopale Resins lb.	.205 /	.135	No. 3186	.28 /	.30	Retardexlb.	.47 / .50 1.14
Piccovol	.165 /	.20	C-33gal.	.215 / .23 / .27 /	.315	Thionex	.37 / .39
Pictargal. Pigmentarlb.	.25 /	.0634	D-4gal. E-5gal.	.25 /	.37 .35 .36	Solvents	
Pigmentaroil	.046 /	.0634	Q-Oil	.60	.061	Bondogen	.555 / .605 .60 / .65
South	.1030/	.1085	150 Pine Solventgal.	.44	.385	Cosol #1gal.	.37 / .43 .42 / .48
42	.34 /	.40 .305	Reclaiming Oil #3186galGgal. 4039-Mgal.	.25 /	.365	Dichloro Pentaneslb. Dipentene DD, Sunny	.04 / .07
B	.35 /	.45	-Y gal.	.30 /	.37	Southgal. Ethylene dichloride, commllb.	.42 / .63 .09 / .122
MP	.035 /	.0755 .7425	RR-10	.015 /	,0225	Hi-Flash 2-50-W gal. Pale yellow gal.	.41
ODN	.35 /	.475 .515				LX-572	.27 / .32 .16 / .23
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DBE	.50 /	.55	Borden, Chem. Div. Arcco 978-42Blb.	.18 /	.19	106	.38 / .46
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Polymel-Clb.	.1775/	.1875	521	.019 /	.02	-H	.148
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R-100	.60	.063	Aluminum Flaketon Bucaton	45.00	60.00	Acintol R	.065 / .07 .0275/ .0375
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3	.48		Paragonton Pigment No. 33ton	13.50 / 37.00	33.00	Galex W-100lb.	.155 / .17 .1525/ .1625
5lb.	.68		Recco		33.50	W-100D	.65 / .84 .70 / .89
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Triacetin	.365 /	.40	Paradene	.07 /	.08	Magnesium oxide	.2575/ .285
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Monsanto	.39 /	.1175	-6B	.36 / .52 /	.43	Stauffer	.0265/ .054 2.75
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Acintol C, P	.02 /	.03	Resinex	.0225/	.1025	White tead sincite (See Accele	erator-Activators, 19-

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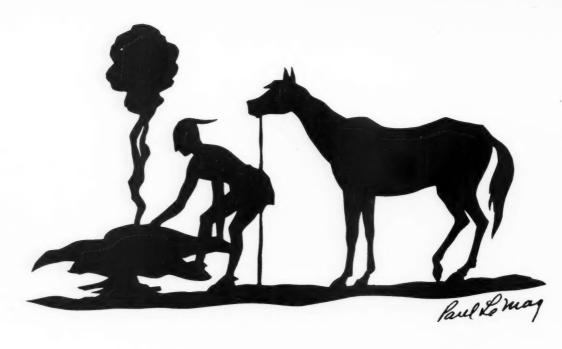
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